



THE  
PROCEEDINGS  
OF THE  
ENTOMOLOGICAL SOCIETY  
OF  
LONDON  
FOR THE YEAR  
1913.

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Wednesday, February 5th, 1913.

Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in the Chair.

*Nomination of Vice-Presidents.*

The PRESIDENT announced that he had nominated as Vice-Presidents for the ensuing session the Rev. F. D. MORICE, M.A., and Messrs. J. E. COLLIN and J. H. DURRANT.

He also spoke a few words of thanks for his election to the Presidency and made suggestions as to the more effective circulation of exhibits.

*Exhibitions.*

MOTHS FROM BRITISH HONDURAS.—Mr. A. E. GIBBS exhibited a number of insects, principally Syntomid moths, from British Honduras, and read the following notes:—

A short time ago I received from Dr. F. L. Davis, F.E.S., of Belize, British Honduras, a most interesting box of insects. They are mostly Syntomid moths, and exhibit some remarkable instances of mimicry. They were collected by Dr. Davis in June, 1912, at Castile on the Belize or Old River, about fifty miles in the interior of the colony. He spent two weeks in this spot, which did not prove such a good collecting-ground



as he expected; but he suggests that he went too soon after a very long hot dry season and would have done better if he had delayed his visit for a couple of months. Castile is a large open savannah with primeval forest on one side, and it was on the edge of this forest that he made nearly all his captures. In the tracks through the dense forest he found hardly any Lepidoptera. The most interesting insects he took were Syntomid moths of wasp-like and fly-like appearance, which were present in abundance. At the edge of the forest were patches of a small shrub with white flowers, and it was on these flowers that he took nearly all his specimens. Dr. Davis says that he found the early morning hours, from sunrise to about 10.30 a.m., the best time. After that the sun appeared to be too hot for them, and, with the exception of one or two of the more brilliant species, they all disappeared. The species which simulate Aculeates and Diptera were found in abundance on the flowers before mentioned, and were easily captured. One of the most interesting moths sent is *Angelox anthracina*, Walk., which is a very close mimic of a wasp, a specimen of which Dr. Davis has sent, and I have placed the model and the mimic side by side for comparison. Both wasp and moth were very common, crawling together over the flowers, and, experienced as Dr. Davis is, he tells me that he made a mistake once and got a slight sting. Another insect of which Dr. Davis sent two specimens, is *Chrysostola angusta*, which was described by Druce in "Biologia Centrali Americana," from a specimen sent home without a body by Champion from Guatemala. This type specimen is now at South Kensington, and was the only one in the national collection until I presented one of those collected by Dr. Davis. Druce's description should be completed as under:—

Abdomen yellow, terminal segments black with purple reflections; a black dorsal spot on the first and second segments.

The collection also contains an undescribed species of *Lotophlebia*, for which I propose the name *darisi*. Of the two specimens sent I hope to present one to South Kensington. The following is the description:—

## LOXOPHLEBIA DAVISI.

Head black, palpi in front, margins of frons, ring round neck and antennae in front near tip white; thorax orange; white stripes on fore tarsi; abdomen brown-black, with white spot on first segment, and a blue shading at ventral extremity; wings hyaline, with orange patches at base, veins and margins black. Fore-wings with apex broadly black and margin widened at tornus, a black line on upper discocellular. Hind-wings with terminal band and basal two-thirds of inner margin widened.

Expanse 31 mm.

*Habitat.* BRITISH HONDURAS, Castile, Belize River, June, 1912, Dr. Davis. Type in British Museum, co-type in coll. Gibbs.

There are three species of *Macrocneme*, dark-coloured insects with brushes of long hairs on the tibiae and tarsi, one of which is either a small specimen of *M. jalapensis*, so far only known from Mexico, or possibly it may be a new species. Of the other two, *M. auripes* is recorded from both British Honduras and the neighbouring republic of Guatemala, while *M. nigratarsis* has been found in the latter country. Two insects having a superficial resemblance but belonging to different genera are *Dinia acagrus* and *Mesolasia haemorrhoidalis*, both handsome insects, the latter especially so. Dr. Davis has noticed that these insects remain on the wing in the sunshine through the hot hours of the day.

There are half-a-dozen specimens of that attractive moth. *Belemia joris*, one of the Arctiidae, and they exhibit some amount of variation in the dimensions of the scarlet band on the fore-wing, which in one of them is almost obliterated. Another moth belonging to the same Family is the beautiful *Agryta dux*, Walk., which has the appearance of an Ithomiid that flies with it in the early morning hours before the sun is very hot. Dr. Davis says that on the wing it is almost impossible to distinguish one insect from the other.

Among the insects of other Orders sent by Dr. Davis, especially interesting is an Hemipteron, a species of *Umbonia*,

probably *U. orozimbo*, Fairm., which he found some years ago in the western district. They have a thorn-like process on the pronotum, and were in numbers on the stem of a small shrub, which Dr. Davis thinks was unprovided with spines, but these insects, ranged down the stem, gave the appearance of a very prickly plant, and one dangerous to handle. They remained perfectly motionless, thus adding to the deception.

There are two beetles which Mr. Champion has kindly identified for me. One of them, a Longicorn, *Crioprosopus thoracicus*, White, a very handsome insect, recorded in the "Biologia" from Honduras only, comes with the moths from Castile, and is the only specimen Dr. Davis has met with. The other, a Buprestid, *Euchroma goliath*, Lap. and Gory, appears to be a commoner beetle of wider range.

Appended is a list of the Syntomidae and Arctiidae collected by Dr. Davis at Castile, British Honduras, in June, 1912:—

SYNTOMIDAE.—*Pheia albisigna*, Walk., *Loxophlebia nasa*, Druce, *L. imitata*, Druce, *L. davisi*, n. sp., *Rhynchopyga flavicollis*, Druce, *Chrysostola (Dycladia) augusta*, Druce, *Macrocneme auripes*, Walk., *M. nigritarsis*, Hampson, *M. jalapensis*, Sch., *Dinia aeagrus*, Cram., *Mesolasia haemorrhoidalis*, Stoll, *Trichura druryi*, Hb., *Argyrodes minuta*, Druce, *Epinyctes imperialis*, Walk., *Napita leucotelus*, Butl., *Aclytia punctata*, Butl., and ab. 1, Hampson, *Heliura rhodophila*, Walk., *Amyeles anthracina*, Walk., *Eryphioides tricipennis*, Butl.

ARCTIADAE.—*Belemia joris*, Butl., *Agyda dur*, Walk. (*Isostola superba*, Druce).

THE FORMS *PICEA* AND *GAGATES* OF *FORMICA FUSCA*.—Mr. DON THORPE exhibited ♂♂ and ♀♀ of *Formica fusca*, var. *picea*, Nyl., from the New Forest, and a ♂ from Belgium, and pointed out that it was standing in the British lists as *gagates*, Latr. He gave a history of var. *picea* as British, and exhibited ♂♂ and ♀♀ of the true *F. fusca*, sub-sp. *gagates*, Latr., from Vienna, and illustrated the structural differences between the two forms on the blackboard. He pointed out that *gagates* has not occurred in Britain.

COLEOPTERA, CHIEFLY FROM HINDHEAD.—Mr. Arthur J. RICHARDS, who was present as a visitor, exhibited several scarce Coleoptera, giving the following data :—

One specimen of *Dytiscus dimidiatus*, taken in a ditch near Birchington, Kent, May 1st, 1908.

One specimen of *Emus hirtus*, found dead under rotten fungi, Sept. 15th, 1910, at Hindhead.

One specimen of *Orthophagus taurus*, taken in cow-dung, at Hindhead, May 15th, 1910.

One specimen of *Odontaeus mobilicornis*, taken by Mr. H. Watkins at Hindhead, June 10th, 1910, at light.

One specimen of *Trichius abdominalis*, taken at Thursley, June, 1909.

One specimen of *Oxythyrea stictica*, taken in a flower of the Blue Delphinium, July 22nd, 1910, at Hindhead.

Three specimens of *Acanthocinus aedilis*, taken at Hindhead : one ♂, May 15th, 1909, and one ♂ found dead in a rotten pine stump, on which was a live ♀ with one antenna missing, in June, 1910.

One specimen of *Monohammus sutor*, taken at Hindhead, Aug. 11th, 1910.

He added that on June 26th, 1910, some alder bushes in the Devil's Punchbowl, Hindhead, swarmed with *Agelastica alni*; not knowing at the time what the species was, and concluding that it was something very common, he had only taken a few specimens, and had never seen another since.

Commander WALKER commented on the exhibit, and observed that the collection was a remarkable one, nearly all the species being of great rarity in Britain.

COCOONS OF MOTHS FROM THE LAGOS DISTRICT.—Mr. W. A. LAMBORN exhibited cocoons of *Deilemera antinorii*, Oberth., together with the moths that emerged from them. He explained that the examples were particularly favourable because the larvae had not been unduly crowded, and were provided with large leaves on which they constructed their cocoons. The result was that the cocoons themselves and the arrangement of the spheres upon them presented a very natural appearance, and showed the resemblance to the cocoons of a

Braconid parasite far more clearly than the more crowded examples that he had sent before and had been exhibited to the Society by Prof. Poulton.

He also exhibited two cocoons of the Lymantriid moth *Euproctis lanaria*, Holl. He had observed that, in the construction of the cocoon, the pupa itself was hidden in the lower part, close to the leaf upon which the structure was built, and that the larva spun above this foundation a spherical, thin-walled fabric which remained perfectly empty. The chrysalis itself was of a pale greenish colour and very well hidden within the yellow silk with which the larval hairs were interwoven. The upper portion of the cocoon was, on the other hand, free from hairs and transparent, so that an enemy could easily see into it.

Prof. Poulton, after studying these Lymantriid cocoons with him in the Hope Department, had inquired of Dr. Jordan and Mr. E. Meyrick, F.R.S., but neither of these naturalists knew of any example at all similar to the ones now exhibited. Prof. Poulton had also written to Dr. Chapman who (Dec. 26, 1912) called his attention to the cocoon spun by the larva of *P. auriglua*, L., which, when going into hibernation, spins a very fair cocoon and then sheds its skin and spins another cocoon, leaving the cast skin in the outer one. Dr. Chapman also mentioned the cocoon of *Orgyia aurolimbata*, Gn., described by him in the "Entomologist's Record" (xv, No. 5, 1903). In this species "the interior of the female cocoon is furnished by the larva when constructing it with a longitudinal partition, separating it into two chambers. One of these is occupied by the pupa, and when the moth emerges she leaves this chamber containing the empty pupa case and enters the other, and so is separated by the diaphragm or partition from the empty pupa case. . . ." Dr. Chapman also mentioned *Hastula hyerana*, Mill., which "hibernates in its cocoon as a larva. After making the cocoon the larva rests for a time, then casts its skin and completes its cocoon in which the cast larval skin is embedded. Some months later the larva pupates. In spinning their cocoons, most larvae make an outer hammock in which the real cocoon is slung. This is a necessity to make a place in which the true cocoon can be laid down properly,

but in some cases this outer hammock, usually flimsy and indeterminate, is really cocoon-like, and has outer lashings. I think *C. neustria*, L., does something like this. This outer hammock obviously affords a basis from which to evolve a double cocoon. We might go so far as to say that the pad and girdle of Papilionids are the cocoon, and that the carpet first spun is the outer hammock. In any case, the outer framework and the inner true cocoon are a foundation for various details to be evolved."

SEXES OF *GONOMETA SUBFASCIA*, WALKER. —Mr. J. A. DE GAYE, F.L.S., who was present as a visitor, exhibited 5 ♂♂ and 8 ♀♀ of *Gonometa subfascia*, Walker, which came from the Rev. Lake S. Noble's collection made in Lagos, S. Nigeria, in 1910. Mr. de Gaye explained how the males were captured while they were trying to get into the breeding cage in which were two newly-hatched females. Mr. de Gaye further stated that he conducted breeding experiments of that interesting species in the hope of getting more males, but the larvae died shortly after the third ecdysis. In support of the statement that the male moths exhibited were those of *Gonometa subfascia*, Walker, Mr. de Gaye quoted a description of male specimens obtained by Sir Gilbert Carter from bred larvae. This description is contained at full length in Mr. W. F. Kirby's "Butterflies and Moths," volume iv, which Mr. de Gaye produced. The male *Gonometa subfascia* is figured on page 130.

Prof. POULTON observed that Dr. Lamborn's previous experiences had made it almost certain that, in spite of the great difference in size and appearance, these insects were the ♂ and ♀ of the same species, but that this evidence had not been considered sufficient at S. Kensington: Mr. de Gaye's experience, however, had now placed the matter beyond doubt.

PAPILIO DARDANUS, BROWN. FEMALE FORM LEIGHI. —Prof. POULTON exhibited the *leighi* female together with one *trophontus* two members of a family bred by Mr. G. F. Leigh from a female parent of the latter form (Proceedings, 1912, pp. cxxxiv-cxxxvi). The two female offspring belonged to Mr. D. Longsdon, F.E.S., who had kindly lent them in order that they might be shown to the Meeting. Prof. Poulton also

exhibited the female parent (*trophonius*) which had been presented to the Hope Department by Mr. Leigh.

Comparing Mr. Longsdon's example of *leighi* with the two Oxford specimens, Nos. 36 and 48 (the type of the female form), described on pp. xxxv-xliii of these Proceedings (1911), it was evident that the resemblance was stronger to 36 than to 48. The specimen was, in fact, rather nearer to *plavemoides* than either of the described examples. The hind-wing patch was pale, like that of 36, and even whiter on the costal side of the cell than in this specimen. The two most costally placed of the sub-marginal hind-wing spots were white, the others fulvous. In the fore-wing, the apical spot (absent from the under surface) was much smaller and the sub-apical bar larger than in either 36 or 48. The three fulvous sub-marginal spots below the bar were as in 36. The most costally placed spot of the bar was white, as in the two Oxford specimens, but larger even than in 48, and there was an additional small white spot on its inner side. The fulvous markings below the fore-wing cell were nearer to those of 36, but were more strongly developed than in this specimen. The spot within the cell resembled that of 36, but its inner end was even paler. The resemblance to 36 rather than to 48 was stronger on the under surface, where, however, the increase in extent and in whiteness of the pale markings was even more pronounced than in either of the Oxford specimens. This was especially the case with the strongly developed "costal gap," and the markings below the fore-wing cell which were much larger than on the upper side and nearly white.

Mr. Longsdon's *trophonius* resembled the parent in the absence of the apical fore-wing spot, but differed in that the spot within the cell was much smaller. The sub-apical bar was faintly tinged with fulvous especially over its costal half. The worn condition of the parent rendered it impossible to decide whether it formerly resembled the offspring in this respect.

FURTHER SYNEPIGONID PSEUDACRAEAS OF THE EURYTIS L. GROUP, BREED BY DR. G. D. H. CARPENTER ON BUGALLA IN THE SESSE ARCHIPELAGO.—Prof. POULTON exhibited two

sets of parent and offspring, J and K, recently received from Bugalla. He also communicated the following notes written by Dr. Carpenter :—

" Dec. 23, 1912.

" There is a synepigonic family of *Ps. eurytus* (J)—the largest I have sent—but only 7 ! There were over 20 eggs, but some failed to hatch : some of the young larvae died out of spite, and when they were full grown I lost one or two owing to the fact that I had not enough boxes with close-fitting lids, and when they began to wander sooner than I had expected, looking for eligible sites for pupation, they escaped. Finally, several *would* try to hang themselves on the side of the box and the pupae fell down and were hopelessly crippled, and died :—Altogether rather a sad story ! These, however, that I do send seem to bear out what I said before, that one can't breed a *pure terra* from a *pure hobleyi*, and that *obscura* is apparently more nearly related to *hobleyi* than *terra* is, seeing that it *can* be bred from *hobleyi*.

	Pupated.	Imago.	
1.	Nov. 22.	Dec. 7.	♂ <i>obscura</i> with a trace of <i>terra</i> .
2.	Nov. 23.	Dec. 8.	♂ <i>obscura</i> with a trace of <i>terra</i> .
3.	Nov. 24.	Dec. 9.	♂ <i>hobleyi</i> . Nearly typical but with the hind-wing bar faintly tinged with fulvous, especially on its outer edge and costal end. The amber tint of the triangle appeared on the upper surface to a rather unusual extent.
4.	Nov. 25.	Dec. 10.	♀ <i>obscura</i> .
5.	Do.	Dec. 10.	♂ <i>obscura</i> with a trace of <i>terra</i> .
6.	Do.	Dec. 9.	♂ <i>obscura</i> with a trace of <i>terra</i> .
7.	Do.		♂ typical <i>hobleyi</i> , but did not clear itself from pupal skin, and died.
8.	Nov. 29.	Dec. 13.	♀ <i>obscura</i> .



"J. The female parent, of the form *hobleyi* was captured in the forest, just above lake level, on Oct. 13, 1912. The parent was a nearly typical form, with the umber colour of the triangle at the base of the hind-wing under surface appearing on the upper to a rather unusual extent. The white bar crossing the hind-wing was prolonged on to the fore so far that a narrow neck connected it with the sub-apical white bar of this wing.

"There were so many young larvae that I could not follow the careers of each individual, and therefore only give dates of pupation. The ova hatched between Oct. 22 and Oct. 26."

Prof. Poulton pointed out that the uniformity of the ♂♂ and ♀♀ of *obscura* was very striking. In this respect the family resembled E. (Trans. Ent. Soc., 1912, p. 711). The trace of *terra* was slightly the strongest in ♂ No. 6, then in ♂♂ Nos. 1, 2, and 5, diminishing in that order; but the differences were very small, even between the extremes. The two females resembled each other, except that the sub-apical fore-wing bar was much fainter in 8. The traces of the umber triangle on the hind-wing under surface were distinct in all six *obscura* forms. In spite of these and other indications of transition, there could be no doubt that the offspring of this family and of E had segregated nearly completely into *obscura* and *hobleyi*, although the proportions of J were not what we should expect from a *hobleyi* parent, whether regarded as dominant or recessive. It would be very interesting if much larger families could be reared.

K. The female parent, of the form *terra*, with fore-wing sub-apical bar nearly white and with a faint trace of the umber triangle, was captured in the forest, just above lake level, on Oct. 23, 1912. In reading the above description allowance must be made for the fact that the specimen was much worn.

The single offspring pupated Dec. 5, and the imago appeared Dec. 18. It was a nearly typical male *terra*, with the sub-apical bar of a rather pale fulvous, and a faint trace of the umber triangle.

Prof. Poulton also stated that he had received a consignment of Bugalla plants from Dr. Carpenter, and that they had

been kindly named by the authorities at Kew. The food-plant of the forms of *Pseudacraea hobleyi*, Neave—a large tree with very hard wood—was now determined (cf. Proc., 1912, p. cxxxvii) as *Chrysophyllum* sp. near *C. kayei*, S. Moore—(*Sapotaceae*). The *Pseudacraea* butterflies and also especially *Planema arenaria* were much attracted by the mauve flowers of the Composite plant *Erlangea tomentosa*, S. Moore. Prof. Poulton also mentioned, in reference to the exhibit of the larvae and pupae of the Hyspid moth "*Callioratis*" *pactolicus*, Butl. (Proc., 1912, pp. lxxxii, lxxxiii), that the food-plant was the Leguminous plant *Crotalaria striata*, DC.

CORNISH PHRYXUS LIVORNICA.—MR. B. HAROLD SMITH exhibited 35 specimens of *Phryxus livornica* taken at light, in South Cornwall, during the last half of May, 1912.

A PROBABLE GYNANDROMORPH OF *ACTIDALIA VIRGULARIA*.—MR. A. BACOT exhibited a specimen of *A. virgularia* having the right wings melanic, the left wings of normal grey coloration. The edges of the grey and melanic areas showed a sharp median longitudinal line. As the right wings were noticeably smaller than the left, the specimen would probably prove on examination to be gynandromorphic.

MR. L. B. PROUT said that the specimen was no doubt a gynandromorph; he observed that a similar specimen had been described by Habich, of Vienna.

RHOPALOCERA FROM THE WESTERN HIMALAYAS AND TURKESTAN.—MR. N. D. RILEY exhibited on behalf of M. André Avinoff a collection of Rhopalocera made on a journey in the Western Himalayas. M. Avinoff, who was present as a visitor, gave the following account of his expedition, speaking in admirable English :—

The Rhopalocera now exhibited were collected during a journey of seven months' duration made by him from Srinagar in Kashmir to Russian Turkestan, travelling by way of Sonamarg, Zoji-la Pass, Leh—whence an excursion into Rupshu near the Tibetan frontier was very interesting—from Leh by caravan through the Kardong Pass, Nubra, Saser Pass, Karakorum (18,500 ft.), Kilian Pass, Karkalyk, Kashgar, Alai valley to Osh, and so to Russian Turkestan.

From Srinagar the fauna above 5,500 ft. was purely

palearctic; Kashmir below that having a fauna characterised by some Chinese elements, which run into India only by the southern slopes of the Himalayas (as *Papilio*, *Apatura*, *Neptis*, *Ypthima*). From Srinagar to the top of the Himalayas the fauna has some similarity with that of Chitral, the Mts. of Bokhara and the eastern Alai Mts. (*Vanessa rizana* and *V. cashmirensis*, *Erebia kalinda*, *Thecla sassanides*; the endemic *Argynnis jerdani* and the Sphingid, *Macroglossa rubra* are closely allied to the Turkestan forms *A. hegemonye*, as found in the Alai Mts., and *M. dueulii*). The Ladakh from Zoji-la has some zoogeographical affinity with the Russian Pamir (*P. machaon ladakensis*, the short-tailed form, is only found on the Pamir plateau, *Pieris deota*, *Colias cogene*, *Erebia manni*, the *Satyrus huebneri* group, *Lycæna ariana*, *L. amphissa*, *Chrysophanus aditya*—which has closely related forms in Pamir). Rupshu has very little connection with other parts of Ladakh and Kashmir, purely Tibetan forms being found there, e. g. *Parnassius acco*, *P. aedestis*, f. nov., *P. n. sp.* allied to *P. cephalus*, Gr. Gr., *Pieris deota*, *Colias stoliczkaana*, *Paroënis pumilus*, *Melitæa balbita*, etc. It is interesting to note that *P. acco*, *P. aedestis* and *C. stoliczkaana* are only found, apart from this locality, in Amdo, Koko Nor and Sikkim. *Colias ladakensis* seems also to be very near to *C. nina* from S. Thibet. All these facts seem to show that the fauna of Rupshu is closely allied to that of Thibet as we know it from collections made in Amdo and Sikkim. The Karakorum is also a part of the same zoogeographical region (*Parnassius acco*, *P. simo* and the *P. sp. nov.* referred to above). Kilian is, however, part of another mountain system allied to the Chinese Turkestan. Tian-Chien, etc. (*P. epaphus hurei*, *P. simo subdiaphana*, *Colias cocandica*, *Satyrus heideneichi*—the big Turkestan form, etc.).

During the same period another collection was made in Aksu (Tian-Chien), amongst which was found the celebrated *Parnassius loxus* of which previously only three specimens were known.

#### Paper.

The following paper was read by Commander WALKER.  
 " *Trichogramma*, Westw., probably synonymous with *Pent-*

thron, Riley (Hymenoptera).'' By R. C. L. Perkins, M.A.,  
D.Sc., F.Z.S.

### Wednesday, March 5th, 1913.

Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in  
the Chair.

#### *Election of Fellows.*

The following were elected Fellows of the Society :—Miss  
BLANCHE A. CONEY, The Poplars, Pucklechurch, Glos.;  
Messrs. LACHLAN GIBB, 38 Blackheath Park, Blackheath, S.E.;  
GERALD F. HILL, Govt. Entomologist, Northern Territory,  
South Australia, Port Darwin, N.T.S.A.; LOWELL MASON,  
22 and 23 Club Arcade, Durban, Natal.

#### *Nomenclature Committees.*

At the request of the President, the Rev. G. Wheeler, one  
of the Secretaries, announced that the Council had nominated  
Messrs. J. H. DURRANT, L. B. PROUT and C. O. WATERHOUSE  
to act as the Representatives of the Society on the National  
Committee on Nomenclature. The Council also recommended  
the appointment of a permanent Nomenclature Committee  
for the Society itself and suggested that it should consist of  
five *ex officio* and two elected members, with power to add to  
their number when necessary, the former being the three  
representatives of the Society on the National Committee,  
the British Representative on the International Committee  
and the Secretary of the Society; the Council also proposed  
the names of Mr. G. T. BETHUNE-BAKER and Dr. K. JORDAN  
as the elected members. No alternative was suggested and  
the recommendations of the Council were unanimously  
adopted. The present Committee of the Society therefore  
consists of the following Fellows:—Messrs. G. T. BETHUNE-  
BAKER, J. H. DURRANT, C. J. GAHAN, Dr. K. JORDAN, Messrs.  
L. B. PROUT, C. O. WATERHOUSE and the Rev. G. WHEELER.

#### *Delegates to the International Congress of Zoology.*

The Secretary also announced that the Council had nomi-  
nated Lord WALSINGHAM, the Hon. WALTER ROTHSCHILD

and Dr. KARL JORDAN as the Delegates of the Society to the 9th International Congress of Zoology.

He also read a letter from Lord Walsingham stating that he had given notice of a proposition to be made at the Congress that the present International Committee on Entomological Nomenclature shall be constituted a Commission with equal powers to those of the Commission on Zoological Nomenclature, and asking whether he might say that he was confident that he was expressing the wishes of the Entomological Society of London in making this proposal.

The Hon. W. ROTHSCHILD pointed out that this would somewhat clash with the instructions given by the Congress of Entomology to the International Committee to take steps that Entomology should be adequately represented on the existing Zoological Commission, these instructions having been originally suggested by the Entomological Society. He added that Entomologists far exceeded in number any other branch of Zoologists and that the forms of animal life they dealt with far outnumbered all others, so that to be adequately represented their voice must preponderate.

Dr. JORDAN observed that there was no possibility of Lord Walsingham's proposal being carried, but that it might be useful in helping forward the claims of Entomologists. He explained that by the present rules of the Zoological Congress only three members of the Committee retired, so that three was the largest number of Entomologists that could be put on to the Committee this year, the Congress having no power to alter its rules, but only to recommend alterations to the next Congress.

After some discussion Mr. L. B. PROUT proposed and the Hon. W. ROTHSCHILD seconded a Resolution "that the Entomological Society does not see its way to officially endorsing Lord Walsingham's proposal."

Mr. J. E. COLLIS proposed to add as a rider "but hopes that as many Entomologists as possible will be placed on the existing Commission."

Mr. J. H. DERRANT proposed as an amendment "that the Entomological Society prefers that Lord Walsingham should bring forward his proposal as his own personal motion."

This was seconded by Mr. DONISTHORPE, but being accepted by the proposer and seconder of the original resolution was put as a substantive motion and carried.

#### *Nature Reserves.*

The Hon. N. CHARLES ROTHSCHILD, being called upon by the President, brought before the notice of the Entomological Society of London, a recently formed society, the Society for the Promotion of Nature Reserves, and briefly outlined its objects.

Mr. Charles Rothschild stated that it was the wish of the Society to secure and hand over to the National Trust for permanent preservation, certain areas in the British Islands which were of general, zoological and botanical interest. The speaker pointed out that Fellows of the Society could assist the movement by joining the Society (there being no entrance fee or subscription), and by making suggestions for desirable areas that should be acquired. The Fellows were urged to apply to the secretaries, W. R. Ogilvie Grant, and the Hon. Francis R. Henley, at the British Museum (Natural History), Cromwell Road, S.W.

A COLEOPTERON RESEMBLING A DIPTERON.—Mr. J. E. COLLIN, on behalf of Lt.-Col. C. G. NURSE, exhibited three specimens of a peculiar insect which Mr. G. C. Champion had identified as a species of *Myiodites*, a heteromorous Coleopteron, captured by Col. Nurse, at Quetta (India) in 1902. They were taken flying along a mud wall all at the same place though on different days. The exhibitor remarked upon their superficial resemblance to Diptera of the family *Cyrtidae* which had led Col. Nurse to submit them to him for identification, though at the time they were caught the manner of flying had suggested their being Coleoptera.

A REMARKABLE COLEOPTERON.—Mr. O. E. JANSON exhibited specimens of a curious form of staphylinid beetle from South Brazil, apparently the *Ecitonomorpha arachnoides*, Wassm. (Deutsche Ent. Zeit. 1889, p. 185). He considered it much more nearly resembled the larval form of certain hemipterous insects than a spider. It was said to be associated with the ant *Eciton hetschkoi*, Mayr.

A COLLECTION OF *LAURENTIA CITRATA*, L. (IMMANATA, HAW.), FROM ICELAND.—MR. L. B. PROUT exhibited a series of *L. citrata*, L., from Iceland, and read the following explanatory notes:—

The comparative fewness of Lepidoptera and their generally extreme variability in regions where they are subjected to rigorous and unstable climatic conditions is a matter of pretty general observation, but is perhaps nowhere better exhibited than in the fauna of Iceland. The remarkable range of variation in that country of the Geometrid moth *Laurentia citrata*, L.,\* attracted the attention of Staudinger on the occasion of his historic voyage, and he published † an analysis of the forms met with, recognising eleven as worthy of diagnosis. Thirty-three years later the Rev. F. A. Walker ‡ discussed his own experiences, although—not being a specialist—he made some questionable and even misleading comparisons of his material with certain British forms. In 1908 § I gave a very full account of the variation of this species and its nearest allies. Just recently, through the courtesy of Prof. Poulton, I have had the opportunity of examining an exceedingly variable Iceland series of *L. citrata*, which furnish the subject of my exhibit this evening, and of the present note.

One of the most interesting facts about them is that they were all taken at the same time and place, so that there can be no question of local or seasonal variation such as enters into the study of the British forms of this species and *L. truncata*. They were collected by Mrs. Agnes W. Thomson on August 16, 1911, at Hvalfjord, Hals. (S.W. Iceland), 9-50 feet elevation, flying in hay. There are 32 examples—21 ♂, 11 ♀—varying in condition from perfect to quite worn.

One ♂ may be regarded as typical, the median area being white, rather lightly dusted over with fuscous scales—recalling English *truncata* more than the sharply white-banded *citrata* forms of Britain and Central Europe. In one other ♂ there may be said to be a pale central area, but this belongs to the group I have named ab. *insolida*—only a central band of the

\* Vide Trans. City Lond. Ent. Soc., xviii, 39, 40, for the synonymy.

† Stett. Ent. Zeit., xviii, 252.

‡ Ent. xxiii, 66.

§ Trans. City Lond. Ent. Soc., xviii, 33-69.

median area being white, proximally and distally bounded by dark bands. It has, however, a slight ochreous-ferruginous hue, which is rather prevalent in Iceland forms. Possibly two other worn ♂s were also similar. All the rest are definitely dark-banded. My series of 18 from the F. A. Walker collection shows the same preponderance.

But amongst these dark-marked forms there is an exceedingly wide range of variation. 2 ♂, 3 ♀ have the entire fore-wing (excepting the almost invariable subapical pale markings) ferruginous, the basal and median areas only slightly darker than the rest (ab. *ferruginea*, Prout); another ♂ still more uniform and one a little more variegated can also be mentioned here. 9 ♂, 2 ♀ belong approximately to Standinger's " var. k " (al. ant. fusciscentibus, margine antico extus albido-maculato), the " fusciscent " shade resulting from a strong admixture of black with the ferruginous of the preceding form. In four other ♂s the blackish has wholly supplanted the ferruginous in the broad median area, producing a form more general in Britain and Continental Europe; to one ♂ the same remarks apply, but that there is an admixture of white in the median area, giving rather a mottled appearance. Finally we have five examples with black basal and median bands but with an increase of white in the intermediate and distal areas, the extreme being a pair (♂, ♀) of the beautiful ab. *thinqcallata*, Sigr. The intermediate form, which F. A. Walker named ab. *cjarensis*, scarcely needs a separate name, on account of the intergrading; one of the three before me (a ♀) agrees with his type, one ♂ has more dark markings in the distal area while the other (also ♂) has so much dark marking there as almost to lose the characteristic aspect.

It may be added that a ♂ of " ab. k " was taken *in cop.* with a fine ♀ of ab. *ferruginea*, but I have not learned of any result of the pairing.

AN ALMOND-FEEDING CHALCID. Dr. K. JORDAN exhibited a species of Chalcid together with its live chrysalis, which he had received for identification from the Director of Agriculture on Cyprus, where the species does extensive damage in the almond plantations. He read the following notes on the subject :—

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The insect has been determined as a species of *Eurytoma* by Messrs. Morice, Morley and Schmiedeknecht, to whom the exhibitor submitted specimens. According to live examples sent the larvae feed on the kernel of the almond and pupate early in the spring in the cavity made in the kernel. The fly appears to emerge in the spring, and presumably lays the eggs in the soft almonds. There was one larva in each almond sent, and neither the shell nor the kernel had any outward sign of frass. Whether the fruit thus infested falls off, is not stated.

Many species of *Eurytoma* are parasitic in other insects, for instance the larvae of weevils. This one is undoubtedly phytophagous. It appears to me to be closely allied to, if not identical with, a species which is very injurious to plums and prunes in South Russia, *Eurytoma schreineri*, Schreiner (Zeits. Wiss. Ins.-Biol. iv, p. 26 (1908)).

The exhibit touches upon some questions of Nomenclature. *Eurytoma* is one of those genera of which Entomologists fight shy on account of the slipshod work of Walker. The advance of our knowledge of the genus has decidedly been retarded by Walker's descriptions. Under such circumstances would it not now be advisable to put the stumbling-block out of the way? It could be done by a careful re-examination of Walker's types, or, if that is not possible for some reason or other, by treating the names as invalid. Science should not suffer for the sake of mere names.

Another point of Nomenclature is raised by the name Herr Schreiner, of St. Petersburg, has given to this or a closely allied insect. He says in describing the species that the insect perhaps deserves to bear the name of *schreineri*, which name he spells with a c. Must we call the species *Eurytoma schreineri*, Schreiner, or *schreineri*, Schreiner (1908)?

The Rev. F. D. MORICE inquired whether the Chalcid was possibly parasitic on something that fed on the almonds, but Dr. Jordan said that those he had certainly fed on the almond itself.

TINEA PALLESCENTIELLA BREED FROM HARE'S HAIR.—Mr. R. ADKIN exhibited specimens of *T. pallescenscella* that he had reared in January last from larvae found feeding in a bale of

hare's hair received from Brandon, Suffolk, in the previous November.

He said the hair in question was without doubt of English origin, and in the ordinary course of preparation the skins from which it was taken would go through a number of processes including washing with a solution of mercury and nitric acid, after which the hair would be cut from the skins, packed in bales and put into store. The bales in which the larvae were found had probably been in store at Brandon for a couple of years, were thence sent direct to London, and the larvae were found in them upon their being unpacked immediately on arrival. There can therefore be little doubt that the bales became infected during the time that they were stored at Brandon.

The portion of hair that he received out of one of the bales was put into a glass jar and it was thus possible to observe the behaviour of the larvae. During the time that they were feeding he could detect no larval tube or case, but on becoming full-fed they spun very tough cocoons, to which a quantity of the hair was attached and in these changed to pupae, and on the emergence of the imagines the pupa skins were left protruding about half their length from the cocoons.

Bales of rabbit hair received at the same time, also from Brandon, were found to be similarly infected with the larvae. It is also on record that the species has been reared from larvae found on a dead cat (Ent. Mo. Mag., vol. viii, p. 299), all animal products, facts which appear to throw doubt upon the correctness of the granivorous habits originally assigned to the larvae.

Mr. SICH referred to Rebel's specimens obtained from a stuffed capercaillie, and Mr. ADKIN pointed out that the source of those specimens was, on Rebel's own showing, problematical.

Mr. DERRANT said that species of *Tinea* were very common in the Brandon district, the refuse of rabbit skins being used as manure. He had beaten two *T. pillescetella* out of ivy, near a fowl-house at Merton.

DISABLING AND OTHER INJURIES FOUND IN LEPIDOPTERA AND THEIR INTERPRETATION.—Prof. FOULTON exhibited the male specimen of *Acræa peneleos*, Ward (*ptasgius*, Grose-

Smith), referred to by Mr. Neave in the Proceedings for 1912, p. lv. The left hind-wing was missing from the specimen, having been lost in the attack by a wagtail, which, as described by Mr. Neave, took place on Jan. 12, 1912, about seven miles North-west of Entebbe. Prof. Poulton stated that injuries of this kind might be called "disabling injuries," and they were characteristic of distasteful groups. An insect which had received such an injury was an easy prey to the enemy, and when it was nevertheless rejected the inference is that it was unpalatable. Although characteristic of distasteful groups, such injuries were sometimes seen in insects with cryptic colouring. These were probably accidental, the enemy having lost its prey after dropping it accidentally, or in consequence of having been itself attacked or frightened. The interest of Mr. Neave's observation was that it actually showed how the disabling injury was inflicted. Another example of the same kind was observed by Mr. G. A. K. Marshall at Mt. Chirinda, Gazaland, S.E. Rhodesia, on Dec. 7, 1901, when a young Drongo seized and rejected the Hypsid moth "*Callioritis bellatrix*, Dalm. (Trans. Ent. Soc., 1902, pp. 358-9). Mr. Marshall picked up the moth which was found to have lost most of its head. The specimen was now in the Hope Department. Prof. Poulton showed the following six examples of specimens belonging to various distasteful groups, exhibiting injuries similar to those of the above-mentioned *A. pectens* and *C. bellatrix*.

*Acraea catubica*, Bours., male: Taveta, British East Africa: Jan. 16, 1906; Rev. K. St. Aubyn Rogers. Left hind-wing wanting. It is possible that this abnormality may be due to malformation or to injury in emerging from the pupa.

*Acraea evadon*, L., form *lucra*, F., male: Oni Clearing, 70 miles E. of Lagos: Jan. 28, 1911; W. A. Lamborn. Found on the food plant, *Commelina*, by the lagoon. The injury was noted before capture. Both left wings were torn off.

*Pathea faecula*, Drury, male: in the forest 4 miles E. of Oni: 9 a.m., Apr. 2, 1911; W. A. Lamborn. This Geometrid moth was found on the ground, and as in the last example, both left wings were torn off.

*Pathea faecula*, female: forest  $\frac{1}{2}$  mile E. of Oni: 4 p.m.

Apr. 19, 1912: W. A. Lamborn. The moth was found, headless and dead, upon a forest path.

*Neureia lamborni*, H. H. Druce, male: forest,  $1\frac{1}{2}$  miles E. of Oni: 5 p.m., Feb. 12, 1912: W. A. Lamborn. The butterfly was found, headless, but still alive, on the top of a leaf 1 ft. from the ground. This and the type, also from Oni (Lamborn), are the only specimens at present known of the species (*Lepteninae*).

*Altis helvda*, Clerck, male: Oni Clearing: Jan. 7, 1912: W. A. Lamborn. Found headless in verandah. This *Geometrid* moth was left intact and alive in the verandah overnight, and had doubtless been attacked by a *Gecko*, the only enemy known to exist in the verandah. Mr. Lamborn notes that this species fans its wings just like a butterfly when walking.

Prof. Poulton also exhibited the two following Noctuid moths belonging to the *Catocalinae* and exhibiting similar injuries, probably the result of accident. The colours of both species were evidently procrustic.

*Hemiptera mendax*, Walker, female: forest,  $\frac{1}{2}$  mile E. of Oni: 4 p.m., Apr. 21, 1912: W. A. Lamborn. The moth was found on a forest path, headless, with most of the thorax gone and also one wing detached.

*Acra protracta*, Holland, female: forest,  $\frac{1}{2}$  mile E. of Oni: 4 p.m., May 29, 1912: W. A. Lamborn. Nearly the whole of the left hind-wing was gone, together with the apical part of both fore-wings. The moth was lying thus injured upon the upper surface of a leaf.

He also showed the following examples of butterflies exhibiting a very different form of injury, namely a snip out of one or both wings inflicted in the attempt to capture—an attempt which had obviously failed. These injuries were by no means disabling and would probably have little effect on the flight of the species.

*Agalimimus missippus*, L., male: Petanke, East Loangwa district (2400 ft.), North-east Rhodesia: Jan. 25, 1905: S. A. Neave. The apical portion of the left fore-wing was sheared off as with scissors; the injury also includes a small notch out of the hind-wing.

*Salanis unacardius nebulosa*, Trimm., male: Stella Bush, nr.

Durban, Natal: May 12, 1902: F. Muir. "This *salamis* was settled on the underside of a leaf when a bird made a dart at it and took the piece out of the wings." The anal portion of both hind-wings was symmetrically shorn off, only just missing the posterior extremity of the body.

*Charaxes ethalion*, Boisd., male: Durban: March 28, 1907: G. F. Leigh. Captured at light. Injury just like that last described.

*Papilio demodocus*, Esp., male: Beaconsfield Road, East London, Cape Colony: Aug. 12, 1905: F. A. Dixey. Injury as in last two examples.

THE SLUGGISHNESS OF THE AFRICAN LYCAENID BUTTERFLY MEGALOPALPUS ZYMNA, D. AND H.—Prof. POULTON exhibited a female example of *Megalopalpus zymna*, observed by Mr. W. A. Lamborn on a stem in the forest, half a mile East of Oni, May 28, 1912. The butterfly was in the same position on May 29, when the right hind-wing was clipped as a means of certainly identifying the specimen. It was seen in the same place on May 30, 31, and on June 1, when it was captured.

Mr. P. A. Buxton asked whether, apart from *Aerona*, there was evidence of the distastefulness of the other genera, and Prof. Poulton replied that there was experimental evidence of the distastefulness of *Aletis*, and that *Pithea* was so conspicuous and so evidently mimicked by other moths that its distastefulness was highly probable. With regard to *Neureia lachrym* only two specimens were known. Mr. HAMILTON DRUCE observed that a second species of this genus had lately come to hand.

### Wednesday, March 19th, 1913.

Rev. F. D. MORICE, M.A., Vice-President, and afterwards Mr. J. H. DURRANT, Vice-President, in the Chair.

#### *Election of Fellows.*

Messrs. THOMAS ALFRED COWARD, F.Z.S., Brentwood, Bowdon, Cheshire; WM. H. EDWARDS, Natural History Dept., Birmingham Museum; LEWIS GOUCH, Ph.D., Entomologist.

to the Govt. of Egypt, Dept. of Agriculture, Cairo; JOHN HEWITT, B.A., Director of the Albany Museum, Grahamstown, South Africa; CARLOS E. PORTER, C.M.Z.S., Professor of Zoology, Agricultural Institute, Santiago, Chile; and GILBERT STOREY, Entomological Research Commission, Natural History Museum, South Kensington, S.W., were elected Fellows of the Society.

#### *Exhibitions.*

CONIOPTERYX LARVAE.—Mr. C. B. WILLIAMS exhibited two larvae of *Coniopteryx lineiformis*, eight of which were beaten from pines at Oxshott on the 16th inst. So far as he was aware this larva had not been recorded since Curtis's "British Entomology," and there were only two continental records of larvae of this family.

Mr. C. O. WATERHOUSE remarked that he had exhibited to the Society, some few years ago, a coloured drawing of this larva, made from a specimen beaten by himself out of pine, but did not know whether it had been recorded.\*

THE GENUS *ECITON* AND *MYRMECOPHILES*.—Mr. DONISTHORPE exhibited various species of ants of the genus *Eciton*, the "Wander Ants," and gave some account of their interesting habits. He remarked that a number of *Myrmecophiles* run with them on their wanderings, including some 50 species of *Staphylinidae*, a few bugs, etc.

Mr. G. E. BRYANT observed that he had taken four or five species of Coleoptera with these ants in Brazil.

#### ANTS FROM THE UNITED STATES AND FROM SWITZERLAND.

Mr. W. C. CRAWLEY exhibited a few ants collected during September 1909, in Pennsylvania and Cleveland, Ohio, including *Polyergus lucidus* and *Formica rubicunda*, two of the slave-makers, with their slaves; and some species collected with Dr. Forel in Switzerland, August 1912. Among the latter were six species and sub-species of *Leptothorax*, *Myrmica rubida*, *M. ruginosa*, and *M. schencki*, ? of *Formicetoxenus nitidulus*, *Polyergus rufescens* taken during a slave-raid, *Plagioprius pygmaeus*, *Lasius niger*, *Colobopsis truncata*, &c.

\*The drawing was exhibited March 18th, 1908, and is recorded on p. xxii of the Proceedings for that year. Only the generic name, however, is given. {Eu.}

and ♀, *Hypoclinea 4-punctata*, *Camponotus lateralis* and *C. aethiops*. The last two species are of especial interest, as they belong to the xerothermic fauna, relics of a post-glacial period. They are southern species, and are only found in one or two sheltered spots as far north as Switzerland.

#### *Lantern Exhibition.*

The Rev. F. D. MORICE, having asked Mr. DURRANT to take the Chair in his place, made the following exhibits by means of the Epidiascope : -

1. Lantern-slides showing the pectinated antennae of the ♀ in the Sawflies *Lophyrus pini*, L., and *Monactenus juniperi*, L., the latter new to Britain and not yet recorded. It was taken pretty freely on juniper at Nethy Bridge in June 1907, by Messrs. H. Scott and C. G. Lamb.

2. Lantern-slides showing paradoxical (secondary sexual) characters in the legs of numerous ♀ Aculeates (Bees, Wasps, and Fossors).

3. Microphotos (on printing-out paper) of the apex of the ♀ "terebra" in *Cimber latera*, L., and *Cimber femoralis*, L. (magnified 90 diameters).

4. Entomological Congress groups at Oxford and Tring. (Lantern-slides.)

During the course of this exhibit, Dr. CHAPMAN, at Mr. Morice's request, explained the manner in which he had seen the wings of the ♀ *Odynerus spicatus* imprisoned between the tridentate middle femora and excavated middle tibiae of the ♂.

Whilst the instrument was in use a most interesting demonstration of its powers was given by Mr. F. Bethell, a box of butterflies, several of the insects exhibited during the meeting, a photograph of one of the early Presidents, Mr. G. R. Waterhouse (which his son, Mr. C. O. Waterhouse, had brought for the Collection of portraits), illustrations of Lepidoptera and their larvae from Hubner, Freyer, etc., being thrown on the screen in turn, the colours coming out with great accuracy, and details of structure being readily appreciable.

#### *Paper.*

A paper by Mr. H. ELtringham, M.A., F.L.S., "On the Scent-apparatus of *Amantia nigrans*, L.," was read by the

Author, the black-and-white drawings by which it was illustrated being thrown on the screen.

Dr. CHAPMAN, having been asked by the Chairman whether he would comment on the paper, said :—

“ The Chairman having called on me, I can only say that I have no remarks to make on the paper except to express my admiration of the careful work that has produced such beautiful results. I have lately been examining the scent-apparatus of male Lycaenids, and having worked with ordinary dry material and by somewhat crude methods, I have met with no elaborate structures such as have rewarded Mr. Eltringham's researches. I may mention that in *Caretis* I have met with a scent-apparatus previously unnoticed, that is possibly new in Rhopalocera. I think certainly amongst European and Asiatic Lycaenids, but it is easier to examine one's specimens than to discover all the literature about them. In *Caretis* the arrangement is very similar to that in many *Sphinxes* and *Noctuae*, a brush arising from the 2nd abdominal segment, and accommodated in a pocket in the following segments. It arises, however, from the dorsal plate instead of the ventral. The hair (or scale) bases in the pocket are modified (as scent-glands?). I may give a fuller account of this later, if no one else will in the meantime elucidate it more satisfactorily in the field and in properly fresh material.”

### Wednesday, April 2nd, 1913.

Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in the Chair.

#### *Election of Fellows.*

Messes. ANDRÉ AVINOFF, Liteyny, 12, St. Petersburg; W. BOWATER, Russell Road, Moseley, Birmingham; J. S. CARTER, Warren Hill Cottage, Eastbourne; JAMES DAVIDSON, M.Sc., Imperial College of Science and Technology, South Kensington S.W.; ARTHUR H. FOSTER, M.R.C.S., L.R.C.P. (Eng.), M.B.O.U., Sussex House, Hitchin; J. A. DE GAYE, King's College, Lagos, South Nigeria; OLIVER HAWKSHAW, 3, Hill Street, Mayfair, W., and Millard, Liphook; and ERNEST



EDWARD PLATT, 403, Essenwood Road, Durban, Natal, were elected Fellows of the Society.

#### *A Correction.*

The Rev. G. WHEELER explained that he had been mistaken in some of his observations on *Argynnis auresiana*, which he exhibited on Oct. 16th (see "Proc. Ent. Soc. Lond." 1912, p. ci), as he had lately heard from Mr. Powell. The name *auresiana* was given by Fruhstorfer not by Oberthür, and a few specimens were already known before Mr. Powell discovered it in numbers at Lambessa as previously stated. It had also been figured by Turati.

#### *Exhibitions.*

TRANSFERS OF BUTTERFLIES. MR. E. ERNEST GREEN exhibited cards showing the transferred wing-scales of butterflies and read the following notes :—

The larger cards show transfers executed by Mr. C. C. Gilbert, of Ceylon. The smaller cards bear transfers by the exhibitor and are designed to show how a useful representative collection may be preserved in an astonishingly small space. Mounted in this manner, a complete collection of the butterflies of Great Britain could be contained in a case measuring only  $4\frac{1}{2}$  inches by  $3\frac{1}{2}$  inches, by  $1\frac{1}{2}$  inches deep. The transfers are firmly set, and will bear handling or transport by post without damage. They also lend themselves to close examination with a lens. The process is equally applicable to both butterflies and moths. It should be mentioned that the transfers consist of the scale pattern only. The membrane of the wing has been entirely removed. To produce the transfers, the dissected wings of the butterflies are placed between two pieces of freshly gummed paper and subjected to strong pressure until dry. If the outline of the wing is then neatly cut out with a pair of scissors, the two layers of paper can be readily separated. One of these pieces carries away the scales of one surface of the wing; the other piece bears the scales of the other surface, together with the wing membrane. The membrane is subsequently peeled off, when the scales—in their natural pattern—remain adherent to the gummed paper. These imprints are

then mounted on cards in the manner now shown. The card affords space for particulars of locality and other data. By this method, a single specimen will produce two complete transfers, one half of each transfer representing the upper and the other half the under surface of the wings of one side of the insect. It will be realised that the scales are shown only in reverse. This does not affect the pattern in any way, and—in most cases—effects little or no alteration in the colour, except in the case of iridescent butterflies, in which the colour is due to surface sculpturing of the scales. In some other butterflies the blue and green markings are apt to disappear during the process. This is found to be due to the fact that the blue (or green) colouring of such butterflies is contained in the wing-membrane itself, the coloured parts being covered by transparent colourless scales. The black and blue *Danaus* afford good examples of this phenomenon. A transfer of *Danaus septentrionis*, for instance, results in a pattern consisting of a black ground with pure white spots: while the descaled wing shows a membrane with a colourless ground and blue spots corresponding with the white parts of the transferred pattern.

The Rev. F. D. MORICE observed that in other orders than *Lepidoptera* scaleless wings were sometimes highly coloured.

Dr. CHAPMAN (and other Fellows) pointed out that this method of scale transference had been frequently employed, and mentioned in particular an American book entirely illustrated in this way, and also the specimens prepared by Mr. R. M. Prideaux, with the bodies, legs and antennae so painted in as almost to defy detection.

A NORTHERN LOCALITY FOR *TETRAMORIUM CAESPITUM*.—Mr. DONISTHORPE exhibited a specimen of *Tetramorium caespitum*, L., ♀, from a colony found by Mr. Evans on the Bass Rock in Scotland, March 21, 1913. He pointed out that the most northern records known in Britain were Denbigh in Wales, and Cambridgeshire and Suffolk in England, and showed a map of the distribution in the British Isles.

ANTS FROM EGYPT.—Mr. W. C. CRAWLEY exhibited the following species, sub-species, etc., which were taken at Helwan during Dec. and Jan. last:—*Messor barbarus*, L., race *egyptiacus*, Em., ♂, ♀; *M. barbarus*, race *striaticeps*.

And., ♀; *Tetramorium caespitum*, L., race *panicum*, Sm., ♀; *Tetramorium* sp. ♀; *Monomorium salomonis*, L., (sens. str.), ♀; *M. salomonis*, var. *sommierei*, Em., ♀, ♀; *M. salomonis*, var. *subopacum*, Em., ♀; *M. destructor*, Jerd., race *gracilliman*, Sm., 4, ♀; *Cardiomegyla batesi*, For., var. *nigra*, For., ♀, *Cardiomegyla* sp., ♀; *Pheidole pallidula*, Nyl., 4, ♀; *P. pallidula*, race *tristis*, For., 4, ♀; *P. teneriffana*, ♀; *Plagiolepis pygmaea*, Ltr., ♀; *Lasius nigro-emarginatus*, For., ♀; *Myrmecocystus* (*Cataglyphis*) *riaticus*, F., race *bicolor*, F., ♀; *Camponotus maculatus*, F., (sens. str.), ♀; *C. maculatus*, race *atramentarius*, For., ♀; *C. maculatus*, race *fellah*, Em., ♀. A Lepismid was found with most species, and a small myrmecophilous cricket (! *Myrmecophila* sp.) with *M. salomonis*, var. *sommierei*. Notes were made of the habits, food, etc., of these ants.

#### *Ninth International Congress of Zoology.*

Dr. K. JORDAN gave a brief account of the Ninth International Zoological Congress which was held at Monaco from March 25th to 29th under the presidency of His Serene Highness the Prince of Monaco, and which he attended as one of the delegates of the Entomological Society of London.

The list of members and associates was well over 700, about two-thirds of which seemed to be present. Entomology was represented by a number of authors of wide repute, such as Kolbe, Horvath, Ch. Oberthur, Simon, Lord Walsingham, etc. A few Entomological papers were read, but the section suffered from scanty attendance, a fate which it shared with many other sectional meetings.

The subject which stood in the foreground at the Congress and aroused an immense interest was undoubtedly Nomenclature. The International Zoological Congress of Berlin, in 1901, had adopted the Law of strict Priority, i.e. priority without exception, much against the advice of the President and Secretary of the Commission on Nomenclature. Many protests against the hardships of this Law had been raised since, and there was a proposal before the Ninth Congress, brought forward by the German Zoological Society, mainly to the effect that exceptions be admissible. The proposal encountered a very strongly supported opposition. For some

time it appeared as if a split was inevitable. But after continued deliberations and long debates moderation prevailed, with the result that the Congress has given the Commission on Nomenclature power to suspend (under proper safeguards) the rules of the Code so that each individual case for which exception is claimed can be considered on its own merits.

In order to meet the wishes of Entomologists as expressed by the first and second International Congress of Entomology, as well as by the Entomological Society of London, the International Commission on Zoological Nomenclature has been enlarged from fifteen members to eighteen, four of whom are Entomologists (G. Horvath, H. J. Kolbe, H. Skinner and K. Jordan). Moreover, it has been arranged that all nomenclatorial matters relating to Entomology are submitted to the International Committee on Entomological Nomenclature (elected by the Entomological Congresses), which will consider them in co-operation with the Entomological National Committees appointed by the Entomological Societies of each country. By this means every Entomologist will be enabled to have his opinion recorded on points which affect the nomenclature of his own special branch of study.

There was a further proposal before the Commission on Nomenclature, brought forward by the First International Entomological Congress, referring to the labelling of "types." The Ninth Zoological Congress adopted the proposal in a slightly altered form, recommending that in publishing a description of a new species or sub-species only one specimen be designated and labelled as type, the other specimens examined by the author at the same time being paratypes.

The social arrangements during the Congress were on a lavish scale, and the members of the Congress had a most enjoyable time in spite of the rather inclement weather. The Tenth International Congress of Zoology will be held at Budapest in 1916, with Dr. G. Horvath as president.

#### *Vote of Thanks.*

At the suggestion of the President thanks were voted to the Society's Delegates for their work at the Congress, and to

Dr. Jordan in particular for his interesting and satisfactory account of it.

*Papers.*

The following papers were read :—

“ On the classification of British *Crabronidae* (*Hymenoptera*),”  
by R. C. L. PERKINS, D.Sc., M.A., F.L.S.

“ Descriptions of new species of the Syrphid genus *Callicera*  
(*Diptera*),” by the late G. H. VERRALL, F.E.S. Edited by  
J. E. COLLIN, F.E.S.

“ Neue Pyrgotinen aus dem British Museum in London,”  
Von FRIEDRICH HENDEL, Wien.

**Wednesday, May 7th, 1913.**

MR. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in  
the Chair.

*Election of a Fellow.*

MR. CHARLES C. BEST-GARDNER, of Rockwood, Neath,  
Glamorgan, was elected a Fellow of the Society.

*Obituary.*

THE PRESIDENT announced the death of Mr. HERBERT  
DRUCE, F.L.S., who was elected a Fellow of the Society in  
1867, and was well known for his work on the *Lepidoptera* of  
Messrs. Godman and Salvin's “ *Biologia Centrali-Americana* ”  
and other important contributions to our knowledge of Exotic  
*Lepidoptera*.

*Library.*

Donations to the Library were announced, and thanks voted  
to the Donors.

*Letters.*

THE SECRETARY read a letter from Lord Walsingham, one  
of the delegates of the Society to the Ninth International  
Congress of Zoology at Monaco.

A letter was also read from the President of the Entomo-  
logical Society of Ontario, extending a very cordial invitation

to the Society to send a representative to take part in the Fiftieth Annual Meeting at Guelph, Ontario, August 27-29. It was announced that the Council had decided to ask Prof. J. H. Comstock, of Cornell University, U.S.A., to act as their delegate on this occasion.

#### *Exhibitions.*

**A RARE WEEVIL.**—Commander J. J. WALKER exhibited a series of *Acalyptus carpini*, Fr., var. *rufipennis*, Gyll., a rare weevil which had not been met with in Britain for many years previously. These specimens were taken on and about a sallow-bush at Weston-on-the-Green, Oxon. in April 1913.

**AN ALBINO EXAMPLE OF TAENIOCAMPA GRACILIS.**—Mr. N. CHARLES ROTHSCHILD exhibited an example of *Taenioampa gracilis* captured in April this year at Wood Walton Fen, Hunts. The specimen in question is white all over, without any markings whatever. The exhibitor remarked that Mr. W. Holland, who had secured the example, had also captured several more of both sexes of this remarkable form, as well as some others approaching to it but not identical with it.

**A NEW BRITISH ANT.**—Mr. DONISTHORPE exhibited a form of *Lasius affinis*, Schenck, an ant new to Britain, of which he had found a colony at Tenby in South Wales, on the sand hills, on April 24 this year. He also exhibited specimens of *L. flavus*, *L. umbratus* and *L. niger* for comparison, and showed by drawings on the blackboard the difference in the scales of all these yellow ants.

**SCALES OF CNETHOCAMPA PITYOCAMPA.**—Mr. H. ELFRINGHAM exhibited a number of the scales composing the anal tuft of the ♀ of *Cnethocampa pityocampa*, Schiff., remarkable as being the largest scales known in any Lepidopterous insect. He also remarked on the absence of urticating spicules (such as are found in *Porthea similis*, Fuess.) in the anal tuft of this moth. Mr. A. BACOT and Prof. POULTON took part in the discussion which ensued.

**THE FEMALE FORMS OF PAPILIO POLYTES, L., IN THE HONG-KONG DISTRICT.**—Prof. POULTON exhibited four males and six females of *Papilio polytes*, L., captured March 10-October 10, 1912, by Capt. R. A. Craig on Stonecutters' Island in Hongkong

Harbour about one mile from the mainland. All the females were of the male-like form *cyrus*, Hübn. (= *pammon*, L.). The collection contained many other species of *Papilio*, but the model of the chief mimetic female of *polytes*, namely *P. aristolochiae*, F., was absent. On the island of Hongkong Commander Walker had described the mimetic and the male-like form of the female *polytes* as about equal in numbers (Trans. Ent. Soc., 1895, p. 470). With regard to the model *P. aristolochiae*, the same author stated (p. 468) that individuals existed in local collections, but that he had not himself taken the species. Mr. J. C. Kershaw, F.Z.S., in his "Butterflies of Hongkong" (Hongkong and London: 1907) stated, as regards the Macao district, that *P. polytes* "is, perhaps, the commonest *Papilio* here, exceedingly numerous all through the wet season, and occurring every month, though scarce in January. The form of ♀, resembling the ♂ is the common one here, the other form of ♀, being rather scarce by comparison" (p. 110). Of *P. aristolochiae* the author wrote (p. 107), "I have never seen this insect in the neighbourhood of Macao, and it is very scarce at Hongkong. . . . It seems to have become rarer of late years at Hongkong."

Finally, Prof. Poulton had received a letter dated May 4, 1913, from Dr. Adalbert Seitz of Darmstadt giving his experience of *P. polytes* in the Hongkong district. Dr. Seitz had collected in 1890 and from June 1891 to February 1892, in Kau-lung, a part of the mainland opposite Victoria on the island of Hongkong and about a mile distant. Dr. Seitz never saw *P. aristolochiae* nor any female of *polytes* except the male-like form *cyrus* (= *pammon*). He examined all the females captured throughout the whole year and they were all alike.\* At Singapore, on the other hand, Dr. Seitz collected (chiefly in 1892) many of the mimetic females of *polytes* and none of the male-like form. In Kandy (Jan.-March, 1902), according

\* Dr. Seitz has written further, on May 9, 1913:

"I saw daily, when the weather was fine, a number of *P. pammon* (*polytes*), which is, after *P. banar*, the commonest *Papilio* of Kau-lung and Hongkong. I remember having seen in one day over 20 specimens, and altogether I must have seen hundreds. I have collected butterflies for nearly 50 years and my eyesight is very strong, so that I can distinguish ♂s and ♀s by their flight, and of course the *pammon* (*cyrus*) ♀s from the *polytes* ♀s, for the two have no similarity at all."

to his experience, the male-like female was rare—he only took it once—while the mimetic *romulus*, F., and *polytes* females were common. Furthermore in the Nilgiri Hills (1903), where he found *P. hector*, L., although not commonly, there was a form of the *romulus* female differing from the Ceylon *romulus* in the same manner that the Nilgiri model *hector* differs from that in Ceylon. Prof. Poulton had been informed by Dr. Jordan that the Ceylon *aristolochiae* is so variable that very large numbers of specimens would be required to establish the existence of any average difference between the species in this island and in S. India.

A FAMILY OF *PAPILIO DARDANUS*, BROWN, BRED FROM EGGS LAID BY A *PLANEMOIDES*, TRIMEN, FEMALE.—Prof. POULTON read extracts from letters received from Dr. G. D. H. Carpenter, telling of his success in obtaining, for the first time, fertile ova from a *planemoides* female of *P. dardanus*.

“ Dec. 2, 1912. *Bapulla, Sorsu Archipelago.*

“ I hasten to tell you of a stroke of extraordinary luck which has fallen to me. Yesterday I was out caterpillaring (there being very few butterflies; but I took my net as I felt sure, if not, I should regret it).

“ On my way home, where the track goes through the gap in the forest belt which I have labelled locality B, I saw fluttering slowly just in front of me what I at first thought was a remarkably large *Planema*; it flew just like a *Planema* that has not been alarmed. Almost at once I realised what it was—a *Pap. dardanus* f. *planemoides*—and, to my great excitement and joy, caught it easily. It was really doing its very best to pretend it was a *Planema*; for instead of wildly fluttering in the net as *Papilios* do, it lay perfectly still for a minute or so like a *Planema*, and remained quiet, so that I carried it in the net straight to my breeding-box in the forest, without a single flutter, although it was in the net nearly half an hour. It was a nice fresh specimen.

“ You will hardly believe that it is the first  $\sigma$  *dardanus* I have caught myself! Save for the one *hippocoon* my boy caught (which you have received) it is also the only one I have seen on this island, and the  $\sigma$  I have only seen once or twice,



so you see it was a stroke of extraordinary good fortune, and the gods of butterfly hunters are particularly in favour at present ! I provided it (or *her*) with nice green young sprays of lime (which I gather Lamborn uses as food-plant), and following his tip, put in a box of earth saturated with sugar solution. Now THEN—To-day I visited the box in the evening and found she had already laid six ova ! So you may imagine how pleased I was—almost as excited as when I saw the first egg of *Pseudacraea obscura*. She will probably lay more, I expect. I know you will be awfully pleased, for (I believe) not only has *P. dardanus* never been bred from in Uganda, but no one has ever bred from the form *planemoides*. I feel I could not have had a nicer end up to my sojourn among the Sesse caterpillars, for by the time the imagines appear I shall almost have done here.

“ *Tuesday, Dec. 3.*

“ I visited the breeding-box this evening: there are now about 20 ova. Madam Planemoides seemed in the best of health—pulse and temperature normal and tongue clean—so there seems every reason to hope her progeny will be even more numerous !

“ *Dec. 17.*

“ The young larvae are thriving well: they all got through the first ecdysis without a fatality and are now undergoing the second. I *am* excited about them. I have always longed to breed this classical butterfly, but never hoped I should do it from a form not hitherto bred from. It is a splendid wind up to my breeding series.

“ *Dec. 20.*

“ By the way, now that the larvae have accomplished their second moult, I have been much struck by their appearance, and this does not seem to have impressed other folk in the same way:—at least I have seen no reference to it in such literature as I possess. What struck me was the likeness to a *freshly extruded bird-dropping*, which, not having been dropped from a height, has kept a cylindrical shape; the anterior and posterior ends of the larva are chalky white, the middle of a curious greenish chocolate (and glistening as a fresh dropping does);

about the middle of the body this dark colour is suffused with white, which is continued downwards and forwards over the sides, thus breaking up the dark into two parts, of which the anterior section is swollen and larger than the posterior, resembling a bird-dropping of unequal diameter. Moreover, the larva sometimes adopts a position slightly bent to one side, the angle being at the white intersection of the brown areas. The filamentous processes at the anterior and posterior ends are not at all conspicuous, and I should not fancy the suggested mimetic resemblance to an *Amauris* larva is a reality: I am very struck with the bird-dropping likeness."

Prof. POULTON said that 3 *planenoides* and 7 *hippocoon* females had been bred from the eggs laid by the Bugalla parent, and that he hoped Dr. Carpenter would exhibit the whole family at the June meeting. He also said that Mr. W. A. Lamborn, when he had read Dr. Carpenter's description of the larvae, expressed his entire agreement with the suggestion that there is, at a certain stage, a procryptic resemblance to a bird-dropping.

PROTECTIVE RESEMBLANCE AND MIMICRY IN THE MEMBRACIDÆ.—Prof. POULTON drew attention to some criticisms recently urged by Dr. Arnold Jacobi in "Mimikry und Verwandte Erscheinungen" (Braunschweig: F. Vieweg & Sohn, 1913). In this work the author had objected to the procryptic interpretation of the bark-like or thorn-like, etc., appearance of the *Membracidæ*, on the ground that these insects have remarkable powers of protecting themselves by jumping. The following passage as well as that quoted somewhat later had been kindly translated for him by Mr. E. A. Elliott, F.E.S., F.Z.S.:

"Not only is there an entire absence of all observations as to the protective value of these resemblances, often certainly very distinct from the human point of view, but the mode of life of these creatures is against it. In order to deceive effectually, protective resemblance demands that the bearer shall remain quiescent among surroundings which harmonise with its appearance, but the *Membracidæ* are, for their size, mighty jumpers, and when approached, or at least when their support is shaken, they disappear after the manner of the

flea. Hence, these attempts and those of Melichar (1904) must be classed under the heading of 'Museum Mimicry' (p. 15).

Prof. POULTON contended that this was a very extraordinary criticism, and urged that it was common for more than one method of defence to be combined in the same individual. It was indeed a well-known characteristic of cryptically coloured species to be exceedingly alert when once disturbed: the cryptic *Acrididae* were obvious examples. In order to obtain direct evidence from a keen and accurate observer in the field, he had written to Mr. W. A. Lamborn, who had carefully studied in the Lagos district the West African species of the group. Mr. Lamborn's reply, dated April 15, 1913, was as follows:—

"In answer to your letter referring to *Membracidae* I certainly think that the shapes and colours of the insects are of cryptic value, more especially when oviposition and the moult from nymph to imago are proceeding.

"I believe I am right in saying that in most cases, if not in all, the eggs are deposited on old dark cortex with which the female harmonises well. Oviposition must take hours: I remember having seen a *Leptocentrus altifrons*, Walk., on two consecutive days still adding to the same egg-mass, and the ovipositing ♀ sits tight over her eggs in an astonishing way. I have cut through stems carefully and have thus been able to examine one more conveniently without causing her to fly up, and I have found by experience that I can always pick off such females in my fingers, which it is almost impossible to do under ordinary circumstances.

"The larvae of all that I know, except *L. altifrons*, are light green and always run up from the brown stem to the softer green part directly they are hatched. The larvae of *L. altifrons* are brown, and I have never seen them on green stems. Though one frequently finds *Membracidae* in communities I am disposed to think that these are composed of one family and have all only just emerged from the nymph-case, and that when hardened up they tend to scatter. I believe that these communities are to be found in situations where concealment tends to be ensured. The grouped individuals of one species.

soon to be described by Mr. W. L. Distant, were certainly all fresh when taken, and all were on a rough brown stem. One frequently finds isolated specimens feeding on green stems, and these are so wary that if one advances a finger they soon take the alarm and spring to a tremendous distance. In the early morning they are certainly more sluggish, but I doubt if one could catch them even then with the fingers." \*

Dr. Jacobi had also contended—and for similar reasons—that the resemblance of certain South American *Membracidae* to ants was without significance from the point of view of mimicry:—

"Poulton has attributed to several genera of these truly wonderful insects a mimetic significance as myrmecoids. In the genera *Heteronotus* and *Hemiconotus* the bladder-like, inflated pronotum, extending backwards almost to the apex of the wings, lends to some species a startling similarity to the body of an ant, and, seen from above, obliterates the rest of the body. Even the tubercles on the petiole of the *Myrmecidae* are reproduced. Yet this is only a case of 'Pseudomimicry.' Ohaus, who observed these creatures in Brazil, informs me that their behaviour bears no comparison to that of the restless activity of ants: like all Cicadas they usually sit motionless on one spot, and if disturbed, they reach safety by means of their splendid jumping powers" (p. 106).

Here too it was quite obvious that the resemblance to an ant might be, and almost certainly was, extremely valuable even to a motionless insect which, when approached too closely, could defend itself in a manner very different from that

\* I have received the following note on the Uganda *Membracidae* from Dr. G. D. H. Carpenter.—E. B. P.

"I am afraid I have hitherto paid very little attention in the field to the *Membracidae*. It has seemed to me, however, that they *can* jump vigorously, yet they take rather a long time to make up their mind about it. A *Membracid* will walk about over a finger for quite a long time, and will even allow itself to be poked before it will finally leap. Perhaps, however, it requires a suitable 'take-off' place from which to jump.

"A species common in Uganda has a large hook curving backwards from the shield. I have found this one in the gut of a green frog; and when dissecting the frog found it difficult to believe that it had not swallowed a thorn. It seemed almost as if the sharp hook *must* perforate the gut."

Oxford, May 25, 1913.

adopted by an ant. Dr. Jacobi admitted the extraordinarily detailed resemblance to an ant wrought in the pronotal shield of the Membracids, but preferred to think that the suggestion of adaptation was entirely invalidated because under certain circumstances another and un-ant-like method of defence was resorted to. It would be interesting to know whether the author regards this extraordinary and detailed likeness to be a mere coincidence.

THE COCOONS OF THE TINEID MOTH *EPICEPHALA CHALYBACMA*, MEYRICK.—Prof. POULTON read a letter dated Feb. 13, 1913, which he had received from Mr. T. Bainbrigge Fletcher, explaining that his second assistant at Coimbatore had arrived, in June 1910, at the same conclusions concerning the production of the spheres upon the cocoons of this species as those reached by Mr. E. E. Green and published in Proc. Ent. Soc., 1912, pp. cvi-cix.

"Many thanks for your letters of 20th and 22nd February with the copy of Green's account of the Cocoon of *Epicephala chalybæma*. It is peculiar that he should have found the larvae descending such a height from a Rain-tree (*Pithecellobium saman*). This tree is commonly grown here but I have never seen the larvae near it, whereas the cocoons are common enough on *Casalpinia (Poinciana) pulcherrima*.

"On coming down here last April I was interested to find, amongst the notes accumulated in the Entomological Laboratory, an account of this little moth from observations made in June 1910 by the Second Assistant, Y. Ramachandra Rao. I transcribe his note:

"Eggs on buds; very small, with striae or grooves.

"Larva bores into buds and feeds chiefly on pollen sacs and the ovary rarely. When full grown it bores its way out through a hole at the base of the bud. Full-grown larvae are beautiful light green with red cross-bands. Full-grown larvae pupate on leaflets (upper surface mostly; sometimes on lower).

"The cocoons are remarkable, as they have on their distal ["upper" was written first, but crossed out and "distal" substituted—E. B. P.] surface a number of froth-like bubbles of a whitish colour. The bubbles are prepared at the hind end of the alimentary canal and excreted. The larva attaches

threads to them, makes a slit in the roof of the cocoon, pushes them out, and then covers up the slit. The bubbles are thus pushed out as they are excreted from the hind end of the body. Each bubble is made up of several chambers.'

"I had noted the difference in the two accounts made independently at Pusa and Coimbatore, but had not made any further observations to see which was right. It is always a drawback to have a common species to work with, as one is then inclined to put things off. Now I am glad to find that Green has made a third and again independent set of observations. But the habits vary slightly in Ceylon by the attachment of the cocoon to posts, etc. Both in Bihar and in Madras I have almost invariably found that the larva makes its cocoon on the leaves of its food-plant.

"I had seen your previous note about the parasitic-cocoon-like structures on the pupa of *Dilemea*, and it at once struck me that the cocoon of *E. chalybæna* was perhaps a parallel case, though I rather doubt whether the pupa is parasitised to any extent. Possibly the anal excretion is simply composed of waste products of metabolism thrust outside the cocoon to get rid of them. The larva itself is parasitised fairly freely."

Concerning Mr. Bainbrigge Fletcher's last suggestion Prof. POULTON said that it was to him impossible to explain the elaborate procedure of the larva as merely due to the necessity for the extrusion of waste products. The whole process was an instinct of the most complex and nicely-adjusted kind, wholly unnecessary for the mere purpose of extrusion. He thought that the hypothesis of Mr. Edward Meyrick, F.R.S., was a very probable one, namely that "the cocoon suggests the appearance of a batch of empty eggshells" ("Exotic Microlepidoptera," vol. i, 1912, p. 22). It was to be noted, however, that the suggestion of parasites might be a protection even to species that were not habitually killed in this manner, because such a method of destruction was so exceedingly common in nature. Mr. J. H. Durrant had informed him that so far the life-history of *Epicephala chalybæna* is unknown—the larvae have only been found hanging on threads—and he had suggested that they mine under the bark of twigs or the young branches

like the larvae of *Marmara*. Prof. POULTON thought that Mr. Durrant would be interested to know that the habits of larvae are very closely in accordance with his suggestions.

A HESPERID DRINKING INK AFTER FIRST MOISTENING IT.—Prof. POULTON said that the following observation—entirely new to him—had been made by his son, Dr. E. P. Poulton of Guy's Hospital, when staying at Grundl See, Salzkammergut, Austria:—

"When at Gössl, we were writing in the open air by a lake: a skipper flew up, and tried drinking up the dried ink with his proboscis, and to make matters easier, he extruded a drop of liquid from the end of his abdomen, and produced a small smudge by moving about his proboscis. He then sucked up the ink" (Aug. 19, 1912).

Dr. E. P. Poulton believed that the species was *Hesperia linea*, L.

WINGS OF DANAINA AND EUPLOEINE BUTTERFLIES KILLED BY BIRDS IN CEYLON.—Mr. J. C. F. FRYER exhibited a large series of the wings of Danaine and Euploeine butterflies from Ceylon, remains of these insects which had been observed by him to be eaten by birds, mainly by the so-called "Wood-Swallow," *Artamus fuscus*: also a few specimens of the same butterflies which had been killed by *Asilidae*, these being distinguished by the fact that the bodies were nearly or quite intact. Prof. POULTON, Mr. G. A. K. MARSHALL, and Commander J. J. WALKER, took part in the discussion which ensued.

Prof. POULTON said he was very much interested in Mr. Fryer's results, and that he was particularly glad to see such a fine body of evidence in the shape of the abandoned wings of butterflies that had been eaten. At the same time the evidence did not appear to him to be as subversive of existing hypotheses as many opponents of the theory of mimicry seemed to think. He was referring not so much to Mr. Fryer's remarks on this occasion as to the reports in the press of his paper recently read before the Zoological Society of London. Prof. Poulton had always combated the opinion of the late Erich Haase that protected species with warning colours enjoy "absolute" immunity from attacks. He was confident that no species in the world enjoyed absolute immunity, and those

forms with special protection and warning colours we should expect to find and did find attacked by certain special enemies able to disregard the means of defence and so gain for themselves a supply of food which was abundant, easily seen, and easily caught. We should expect to witness such attacks more readily than any others, because the prey were themselves slow flying, and locally abundant. Such facts were well known among the insects specially defended by stings, no less than in those protected by an unpleasant taste or smell. Thus bees were well known to be attacked by special birds, and a similar relationship to enemies would no doubt be found in all insects, however well defended. The same argument held with regard to procryptic colouring. It was erroneous to suppose that concealment was always efficacious; on the contrary, large numbers of insect-eating vertebrates preyed habitually on insects with procryptic colouring. Concealment was none the less an essential aid by which a species was able to keep up its average numbers because a vast number of individuals above the average were destroyed by enemies of one kind or another. The same facts held for the specially protected species with warning colours, only here we must look to the frequent attacks of a few specialised enemies as well as to a relatively enormous slaughter by parasitic insects, rather than to less frequent attacks by a very much larger number of enemies and a smaller amount of destruction by parasites, as in the procryptic species. One observation of Mr. Fryer's seemed to him particularly significant—the *Papilio agamemnon*, L., which he had seen to be attacked and mutilated by the drongo. This observation fell into line with many other records of injuries seen to be similarly caused; and the whole body of such evidence might be fairly brought forward as proof that injuries of the same kind were inflicted in the same way. If this be admitted we were at once confronted by an immense body of circumstantial evidence indirectly proving the continual persecution of butterflies by birds. Collectors had only to look out for such evidence in the specimens they would generally be inclined to reject, in order to place beyond the reach of doubt the conclusion that butterflies are constantly attacked in this manner.



*Papers.*

The following papers were read :—

“ On the British *Mycetophilidae*,” by F. W. Edwards, F.E.S.

“ *Culicidae* from Papua,” by Frank H. Taylor, F.E.S.,  
Government Entomologist to the Australian Institute of  
Tropical Medicine.

“ Pupal Coloration in *Papilio polytes*,” and “ The larval  
habits of the Tineid moth *Melasma energea*, Meyr.,” by  
J. C. F. Fryer, M.A., F.E.S.

**Wednesday, June 4th, 1913.**

Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in the  
chair.

*Royal Patronage.*

The PRESIDENT announced that HIS MAJESTY THE KING  
had been graciously pleased to become Patron of the Society.

As this fact does not imply the addition of “ Royal ” to the  
title of the Society, a discussion arose as to whether permission  
to make this alteration should be sought, and eventually, on  
the motion of Mr. H. ROWLAND-BROWN, seconded by Mr.  
C. O. WATERHOUSE, it was resolved that the question should  
be discussed in October.

*Obituary.*

The death of Lord AVERBURY, the oldest Fellow of the  
Society, was announced, and also that of Mr. PHILIP DE LA  
GARDE.

*Election of a Fellow.*

Capt. F. SITWELL, Wooler, Northumberland, was elected a  
Fellow of the Society.

*Exhibitions.*

A SCARCE ABERRATION OF RHYNCHITES AENEVIRENS.—  
Mr. C. O. WATERHOUSE exhibited a blue variety of the female  
of *Rhynchites aenevirens* recently taken at Burnham Beeches.  
Males of this blue colour are not so uncommon, but the female  
is extremely rare.

TATOCHILA IMMACULATA, ROB. Dr. F. A. DIXEY exhibited  
a male and female specimen of *Tatochila immaculata*, Röber,

with a pair of *T. stigmadice*, Stdgr., for comparison. He said: "The first-named specimens were presented to the Hope Collection by Mr. C. M. Dammers, having been captured by him in Tucuman, N.W. Argentina, in March 1912. They show points of resemblance to *T. stigmadice*, Stdgr., and *T. xanthodice*, Luc., but are clearly distinct from either. I at first thought that they represented a new species, but on further examination it appeared that they might be referred to a form described by Rüber in Seitz's 'Macrolepidoptera of the World' as *T. immaculata*, though in one small respect the male does not exactly tally with Rüber's description. He says that the dusky stripe in the cell on the under-side of the hind-wing is indistinctly forked at the distal end. In the present male specimen it is not forked at all.

"The genus *Tatochila* to which these species belong, is entirely confined to South America. It is undoubtedly a natural assemblage, though its generic rank may possibly be open to question. Its nearest affinities appear to be with the *Metaporias* of Central Asia, and it has also points of contact with *Synchlœ*. The scent-scales of those members of the genus which possess them are unusually large and quite distinctive. It is interesting to note that I find no scent-scales in *T. immaculata*, nor *T. demodice*, Blanch., though *T. stigmadice*, which seems to be much nearer to *immaculata* than *demodice* is, possesses them in good numbers.

"The present, though not a new species, appears not to be well known. We may confidently hope that Mr. Dammers will do much to increase our knowledge of the fauna of the interesting district of the Neotropical Region to which he is devoting his attention."

ANTS AND THEIR GUESTS.—MR. DONISTHORPE exhibited a fine series of *Claviger longicornis*, Mull (including live specimens), with its proper host *Lasius umbratus nirtus*, with which he had taken it at Box Hill on May 16 and 23. He also exhibited the common *Claviger testaceus* (to show how very distinct *C. longicornis* is) with its principal host *L. flavus*; and specimens of the Acari *Trachypropoda hstocki*, *Sphaerolaelaps holothoroides* and *Antennophorus uhlmanni* taken at the same time.

He gave an account of the history of *C. longicornis* both

A USEFUL APPARATUS.—Dr. G. B. LONGSTAFF exhibited a simple apparatus which he had designed, with the assistance of Mr. H. Eltringham, to turn over several butterflies at once, so as to display alternately the upper- and under-sides. It was manufactured by W. Watson & Son, 313 High Holborn.

BEE AND PARASITE.—Dr. LONGSTAFF also exhibited a small bee (*Andrena*, sp.) with a coleopterous larva, apparently a Meloid, partly on, partly in its abdomen. Captured near Seville, Spain, April 15, 1913.

A PALE TAENIOCAMPA GRACILIS.—Mr. J. C. F. FRYER exhibited a light specimen of *Taeniochema gracilis* for comparison with that exhibited at the last meeting by the Hon. N. C. Rothschild.

THALPOCHARES OSTRINA FROM PAIGNTON.—Comm. J. J. WALKER exhibited, on behalf of Dr. R. C. L. PERKINS, a specimen of *Thalpocharis ostrina*, Hübn., var. *carthami*, H.S., apparently freshly emerged from pupa. This was taken by Dr. Perkins at Paignton on June 1, 1913.

THE RESEMBLANCE BETWEEN THE UNDER SURFACE OF MANY SPECIES OF MELITAEA AND THAT OF CERTAIN PALAARCTIC HESPERIDAE.—Prof. POULTON said that he had called attention to the striking resemblance between the parts of the under-side exposed during rest of many species of *Melitaea* and certain *Hesperidae*—especially the large species *H. andonia*, Spey., *H. subar.* Esp., and to a less extent *H. carthami*, Hübn. (Proc. Zool. Soc., 1911, pp. 866-7). This resemblance had very much struck him in looking through a collection of butterflies made about 1906 in the Tian-Chan Mountains in Central Asia, and belonging to the late Mr. Henley Grose-Smith. Prof. Poulton had no means of ascertaining whether the captures were effected in Russian or Chinese Turkistan. The details of the resemblance are described in the paper referred to. In order to test the hypothesis of a mimetic association, he had in 1909, with the help of Commander Walker, sent many living specimens of the English *Melitaea aurina*, Rott., to Mr. R. I. Pocock, F.R.S. His experiments in the Zoological Gardens, as recorded in P.Z.S., 1911, pp. 825-6, left little doubt, when they were looked at as a whole, that *Melitaea* does actually possess qualities that would render it

an advantageous model. Since that date he had lost no opportunity of inquiring of those who know the *Melitaeas* and these *Hesperidae* during life to give him an account of their experiences, and he now brought forward the following evidence. A very interesting account had been given to him by M. Avinoff, whose beautiful exhibit of Central Asiatic butterflies, earlier in the present year, would be remembered by the Fellows. The following letter from M. Avinoff was written in April 1913 :—

"*Pyrgus antonia maxima* I have caught myself in the Eastern Transalai Mountains, Bordoba, under the Kisl Art Pass, 11,000 ft. It was not very numerous there and was flying with *Melitaea minerva* and *M. didyma*, which were much more abundant. Both the *Melitaea* and the *Pyrgus* have the habit of resting for the night on tall plants, such as *Artemisia* or *Carduus*. I saw them myself sitting side by side, and can affirm that the pattern of the wings is very much alike.

"Exactly the same relationship is repeated in Tian-Chan. At any rate I have received, from Sary Djas, Central Tian Chan, *P. sidae* intermixed with *M. asteroides*, although my collector in the locality sent me no special observations on the biology of the case.

"In the South of Russia *P. sidae* is often found with *M. didyma*, but there the resemblance is not so well marked as in Tian-Chan."

In illustration of his observations M. Avinoff had sent the following specimens which were exhibited to the Society : From the Transalai Mountains in Russian Central Asia *Melitaea minerva*, Staud., *M. didyma*, Ochs., and *H. antonia* ; from the Tian Chan Mountains (from the Russian slopes close to the frontier between Russian and Chinese Turkestan) *M. minerva*, *M. asteroides*, Staud., and *H. sidae*. Together with these Prof. Poulton exhibited a series of specimens which had been partly purchased from Mr. Grose-Smith and in part kindly given to him by Mr. J. J. Joicey, F.E.S. These included six examples of *M. minerva*, three of *M. didyma*, two being of the var. *ala*, Staud., one *M. arduinna*, Esp., one *M. asteroides*, f. *solana*, Alph., six *H. antonia*. Accompanying these was a single example of *Brenthis hegemone*, Staud., showing

an under-side appearance probably mimetic of the *Melitaeas*. This last exhibit, taken in conjunction with *M. Avinoff's*, proves that both of these mimetic *Hesperidae* occur with the numerous *Melitaeas* in the Tian-Chan Mountains. It appeared, so far as it was possible to infer any conclusion from so small a collection, that *M. minerva* was the dominant species of the group, and that the next in importance was *M. didyma*. Nearly the whole of the exhibited specimens were pinned so as to show the under-side pattern on which alone the mimetic resemblance is to be seen.

Prof. POULTON had written to Mr. Harold Powell, F.E.S., a naturalist who had gained much experience of these species in the field.

Mr. Powell had kindly replied, Oct. 22, 1912, from Lambessa, Constantine, Algeria:—

"The under-side of *H. sidae* is certainly suggestive of *Melitaea*. I noticed the resemblance a long time ago, but I did not pay any special attention to it.

"When the sun is out *sidae* rests with its wings open, and in that position it does not look much like a *Melitaea*, at any rate when seen from above as we usually see it when at rest. Seen from below it is quite possible it might be mistaken for a *Melitaea* by some enemy.

"I do not remember having seen *sidae* resting at night or in cloudy weather. It no doubt has its wings closed then, with the fore-wings dropped between the hind-wings and the antennae nearly at right angles to the body and slightly drooped, as in the case of the different *Hesperia* species I have seen resting at night. They generally settle in a prominent position such as the top of a stalk, blade of grass or end of a branch, for night rest. The following *Melitaea* species occur in the locality where *sidae* is found, in the Plan du Pont Valley at Hyères: *M. cinxia*, *M. didyma*, *M. phoebe*, *M. athalia*. A large form of *M. cinxia* is fairly common in April. It is going over by the time *H. sidae* appears, but is still on the wing. *M. didyma* flies at the same time as *H. sidae*, but is not abundant. *M. phoebe* is scarce. *M. athalia* is sometimes very common, but it flies late in May when *H. sidae* is nearly over. It is particularly abundant on a hill-side about

a kilometre away from *sidue's* special locality, but it is also common enough where *sidue* flies."

THE HABITS OF TWO ALGERIAN DIPTERA—AN ASILID AND AN ONCODID.—Prof. POULTON exhibited a female of the Asilid fly *Heligmoneura braunipes*, F. (*Asilus castanipes*, Meigen), together with the Oncodid (Cyrtid) fly *Physegaster maculatus*, Macq., both from Batna, Algeria—the Asilid dated July 2, 1909. Neither of these was present in the British Museum collection, but Mr. E. E. Austen had kindly named them from H. Lucas' "Expl. Sci. de l'Alger," 1849. The Oncodid Mr. Austen considered to be the same species as that represented in fig. 6, plate iii of vol. iii (p. 445), the Asilid that represented in fig. 8, plate ii of the same volume (p. 440). The two specimens had been sent by Dr. Adalbert Seitz with the following interesting notes upon their habits:—

"There is to be found upon the wing from the end of May until August a horrible fly, a great danger to all day-flying insects. I found the largest butterflies killed by it, for instance: *Papilio podalirius*, *P. machaon*, *Argynnis pandora*, *Colias edusa* and *P. dapliciae*. *Anthracaris caepheno* I found only once, for this species is over before the Asilid is common. I observed a common Noctuid moth, *Thalpochares albida*, which rests on the thistles, but never flies by day, and this is exceptional, for all *Thalpochares* are day-fliers. Once I disturbed two *T. albida* on the ground, so that they had to fly, and immediately they were caught by the Asilids. I also found plenty of *Anisoplia*, *Cicadidae*, etc., etc., caught by the Asilid, and sometimes I found the females devouring their own males.\* But I did not observe the capture of a single Zygaenid moth, although they fly in numbers amongst the voracious Asilids. Nor did I observe the capture of a Myla-brid beetle. Together with the Asilid I send another fly, an Oncodid, upon which it preys. This fact astonished me; for the Oncodid hovers like a Syrphid in the holes made in the ground by spiders. The short wings enable it to hover even in narrow holes, and it hums so loudly as to attract

\* Dr. Seitz once found a female *in capiti* with one male and devouring another, all three insects being of the same species, viz. *H. braunipes*. A pen-and-ink sketch of the three accompanied the exhibit.

attention. The sound is very curious, and I have rarely detected the fly by any other means. When one attempts to catch it the fly retreats more deeply into the hole, so I find it difficult to understand how the Asilid can seize it.

" Seeing your collection of *Asilidae* and their prey I formed the intention of obtaining a set of insects captured by this Asilid, and I hope on my return to Algeria in June to be able to send you a good series of them."

Prof. POULTON said that the latter observation doubtless bore upon the fact that the larvae of *Oncodidae* are parasitic upon spiders. It was interesting to learn that this Algerian Asilid drew the line at the *Zyggenidae* and a Mylabrid; for certain other species are known to attack the most specially protected insects. It was clear that each species must be studied separately and that a very large body of evidence was required.

A LOCUSTID AND A REDUVID MIMIC OF A FOSSORIAL ACULEATE IN THE S. PAULO DISTRICT OF BRAZIL. Prof. POULTON exhibited on behalf of Dr. ADALBERT SEITZ, F.E.S., the Fossorial model *Pepos styphreus*, Pal. de Beauv., and two of its mimics—the Reduviid bug *Spiniger ater*, Lep. and Serv., and the Locustid (Phasgonomerid) *Scaphota usata*, Thunb., var. *caposa*, Kirby. All three had been captured, together with a third mimic, a Syntomid moth of the genus *Macrocheilus*, by Dr. Seitz, along not more than 200 paces of a sunny road through the high forest between Santos and the little village of São Vicente about the year 1888, although Dr. Seitz believed that he had seen all three insects upon the wing in every month in the year. He had written, May 4, 1913, with additional details in a later letter: " At this spot the Fossor, a species of *Pepos*, is very common. It appears on the wing about 10 a.m., and flies slowly up and down the road. At this time of day large spiders may often be seen crossing the road, and in a moment they will be captured by the Fossorial wasp, &c. The Fossor is a very powerful insect, stinging very badly, and it is the model of several different insects. Among the mimics are Syntomid moths of the genus *Macrocheilus*. The Fossor, when on the wing, carries its legs hanging down like our *Psephenophora*, and I observed that the *Macrocheilus*

does the same, in mimicry, I believe, of the Aculeate model.

"The *Pepsis* is also mimicked by a Reduviid bug and a Locustid of which I send specimens. The likeness is not at all striking when the insects are at rest, but both of them have the very curious habit of flying and running alternately and of running short distances with expanded wings.\* The *Scaphura* when active directs its antennae forward, but these organs sweep backward in the resting position, in which the insect appears to be non-mimetic. I was somewhat surprised to see that the *Pepsis* does not attack its mimics. Many of the American Fossorial wasps hunt the Orthoptera, but not this kind."

Prof. POUTROX said that in view of Dr. Seitz's last sentence, it was interesting to find that H. W. Bates, in his epoch-making memoir (Trans. Linn. Soc., xxiii, 1862, p. 509) had spoken of these very *Locustidae* as the prey of their models:--

"Amongst the living objects mimicked by insects are the predaceous species from which it is the interest of the mimickers to be concealed. Thus, the species of *Scaphura* (a genus of Crickets) in South America resemble in a wonderful manner different Sand Wasps of large size, which are constantly on the search for Crickets to provision their nests with. Another pretty Cricket, which I observed, was a good imitation of a Tiger Beetle, and was always found on trees frequented by the Beetles (*Chlaenius*). There are endless instances of predaceous insects being disguised by having similar shapes and colours to those of their prey; many Spiders are thus endowed; but some hunting Spiders mimic flower-buds, and station themselves motionless in the axils of leaves and other parts of plants to wait for their victims."

Prof. POUTROX questioned the interpretation of mimetic resemblance given by Bates in the paragraph quoted above, although he did not doubt the anticryptic significance of the flower-haunting spiders. He had argued, in Trans. Ent. Soc., 1901, pp. 661-5, that the mimicry of their Hymenopterous prey by certain Asilid flies, and of *Bombus* by the Volucellas which lay eggs in their nests, is not to be explained in the

\* This description was illustrated by a sketch of the two mimics, made from memory by Dr. Seitz, and fixed beside the specimens.



manner suggested by Bates or still earlier by Kirby and Spence, and followed in 1890 by the speaker himself ("Colours of Animals," p. 267). All such examples were better interpreted as a protection from enemies that feared the stinging Hymenoptera. The particular models were peculiarly advantageous because of the special association between them and their mimics. If the *Scaphurus* mimicked their Fossorial foes the resemblance was probably to be explained in the same way, and not as a means of escaping the attacks of their models. In the meantime Dr. Seitz's observations showed that these *Locustidae* may mimic Fossors which attack other prey.

The resemblance of the thickened basal segments of the Locustid's antennae to the entire organ of the model was found throughout the genus *Scaphura*, which was probably mimetic in all its species. The sudden thinning away to the diameter of the usual hair-like Locustid antenna as well as the appearance of a yellow "tip" at the end of the thick basal section—about one-third of the whole organ in length—was very striking. There was also a peculiar quality about the annulation of the basal part which strongly suggested the antennae of the Fossor. The example afforded a most instructive comparison with the mimetic likeness of certain Longicorn beetles to weevils and Phytophaga, as described by Mr. C. J. Gahan. In these cases, which he had quoted in *Linn. Soc. Journ. Zool.* xxvi. 1898, p. 596, the terminal part of the too-long antennae of the mimic was concealed by a hair-like fineness, while a false "tip" was indicated by a special dilatation (in *Dolopis*, or by hairs (in *Estopocorda*).

The antennae of the *Pepis* sent by Dr. Seitz were entirely yellow and not black with yellow tips like those suggested by both *Rehynid* and Locustid mimics. The fine series of *Pepis* *supplicae* in the British Museum, kindly shown to him by Mr. G. Morda-Waldo, included specimens from localities widely distributed over the whole Neotropical Region, and in these the antennae were very variable in colour, being more often black than yellow. Concerning the varieties in the Santos district Dr. Seitz had written: "This Fossor, so far as I remember, *always* has yellow tips to its antennae at

Santos. We have, however, in this locality different species of these Aculeates: I remember seeing a *Pepsis* with the apex of fore-wing *white*, and so on."

The specimens of the Reduviid and of the Locustid in the British Museum were labelled Brazil. As Dr. Seitz had been unable to send a specimen of the moth, Prof. Poulton had included *Macroceme lades leucostigma* from Castro, Parana (2,900 ft.), March 16, 1910, kindly given to him for the purpose by Mr. W. J. Kaye.

Prof. POULTON also drew attention to the blue-black iridescence still distinct on the abdomen of the Locustid, and probably far more brilliant in the living insect.

SYNEMGONIC SERIES OF *PAPILIO DARDANUS*, FROM PARENT FORM *PLANEMOIDES*.—Dr. G. D. H. CARPENTER gave the following account of a brood of *Papilio dardanus* raised by him from eggs laid by a ♀ of the *planemoides* form:—

"The parent *planemoides* was taken on a track through the forest belt (a comparatively open space) on Bugalla Island, Sesse, I. Victoria, on Dec. 1, 1912, and at once put into a breeding-box in the forest, with sprigs of lime. She laid 26 *ova* on the 1st or 2nd, and though left till Dec. 8, yielded no more. The *ova* all hatched Dec. 8-9. The dates for the *successive ecdyses* are those of the first larvae in each case.

"I, Dec. 13; II, Dec. 17; III, Dec. 22; IV, Dec. 28.

"When I counted them after the beginning of the third ecdysis *twenty-five* larvae were all I could see—one had apparently escaped or got lost in changing food-plants. When the majority of the larvae were nearly full grown, for some reason *three* individuals lagged behind—and of these two died—the other grew very very slowly and finally died on Feb. 9. There are therefore *twenty-two* *imagines*: 7 *hipparion*, 3 *planemoides*, the rest males.

"As regards the act of pupation, I watched this through in several instances, for I had been much puzzled by the account given by Trimen. He mentions that the antennae, as well as the cephalic tubercles, are both used to 'push the loose skin between the suspensory threads.' It seemed to me very extraordinary that the newly-formed organs (which in all instances I had previously seen were more flaccid tubes

full of fluid) should be endowed with power of movement, so I watched for this very carefully. *I saw no signs of it in any case.* The skin is withdrawn from the head and thorax in the invariable manner, and the appendages are simply drawn into their symmetrical position by the passage of the larval skin towards the abdomen—being as helpless and flaccid as usual.

“ As regards the cephalic tubercles, in all my pupae they were *far* too short to extend to the level of the silken thread (which before pupation girdles the body between the 2nd and 3rd abd. segments, but as soon as the larval skin has been withdrawn beyond it is shifted forwards by adroit movements so as to lie between thorax and abdomen of the pupa); the only movement which they underwent was rotation through half a circle being at first flexed on the ventral aspect of the head, and later on assuming a position in a line with the long axis of the body. As was the case with the much longer processes of the pupae of *Pseudacraea caryates*, previously described, the straightening out of these processes seems to be caused by the pumping into them of fluid.

“ The pupae begin to show colour 24 hours before emergence of the imago. In the *case of the male*, a peripheral black line surrounds the wing, and the pale apical dot soon becomes marked out.

“ In the case of the *phycopodites*, the first part to become dark is the future orange band on the fore-wing; this at first shows black, then becomes gradually orange, while the rest of the wing area becomes black.

“ The darkening in the case of *hippocoon*, is very interesting. At the very commencement, when the dark areas are only just beginning to define themselves, the condition is very similar to that of the male. There is a dark peripheral border to the costal and hind margins, but along the course of the latter is a single large indentation. This marks the site of the future large subapical white patch. By degrees the black seems to invade the rest of the white area, cutting off the apical from the basal white areas, as indicated by the dotted lines in the diagram. I wonder if this ontogeny recapitulates, as it were, the phylogeny, showing how *hippocoon*

came to be differentiated from the male? It is a very easy process to understand.

" I apologise for the poor condition of the males, they will flutter about and break their tails even before their wings are dry, and I had great difficulty in killing them without letting them escape. Indeed several I put into a large box as soon as they came out of the pupa, kept them in the dark until night, and then executed them. It was a good thing there was no one about to hear how I abused them as they broke their tails in the killing bottle!

" As regards the *larvae*, the subjoined are rather rough notes on their appearance. Before the first moult they are blackish, a little white showing posteriorly. *After first moult* they are chocolate with the greater part of the anterior and posterior two segments white; *after second moult* some white appears in the middle of the body as a dorsal suffusion over the chocolate running downwards and forwards dividing the chocolate area into two, the anterior part of which is somewhat more swollen than the posterior. The lowest part of the body at level of bases of legs is white all along. During this stage I was very much struck with the likeness to a large bird dropping— one which has been extruded while the bird sat on a twig, and has not fallen from a height so as to obliterate its cylindrical shape. The curious glistening line of the chocolate areas which sometimes makes them look greyish, the more swollen anterior part of body, the attitude of the larva (it often rests with this anterior part slightly deviated to one or other side), and the great sluggishness of the larva, all contribute very materially to the resemblance, which struck me very forcibly.

" *After the third ecdysis* the larva becomes too big to gain by resemblance to a bird dropping, and the white at the anterior extremity becomes invaded dorsally by the chocolate, which becomes gradually lighter in hue, eventually turning greenish. *After the fourth ecdysis* the head changes from black to green; the filaments from segments I and II become very short and stunted— the dorsal white on the anterior two segments is wholly replaced by green, and the chocolate hue elsewhere has now become leaf green, with two or four tit

varies in different larvae) dorsal blue dots on each segment. The suffusion of white in the middle of the body in some cases disappears altogether, so that some larvae are pure leaf green, with dorsal blue dots.

" I give below the dates of pupation, and emergence of the imago.

<i>Number on paper of Imago.</i>	<i>Pupation.</i>	<i>Date of emergence.</i>
1	Jan. 7	♂ Jan. 23 before sunrise
2	"	♂ Jan. 23 "
3	Jan. 8	♂ Jan. 24 "
4	"	♂ Jan. 24 "
5	"	♀ ( <i>hipp.</i> ) Jan. 23 "
6	"	♀ ( <i>hipp.</i> ) Jan. 24, 9 a.m.
7	"	♀ Jan. 24 at dawn
8	"	♀ ( <i>pluv.</i> ) Jan. 23 before dawn
9	"	♀ Jan. 25 "
10	Jan. 9	♀ ( <i>hipp.</i> ) Jan. 25 "
11	"	♀ Jan. 25 "
12	"	♀ Jan. 25 "
13	"	♀ Jan. 24 at dawn
14	"	♀ ( <i>pluv.</i> ) Jan. 24 before dawn
15	"	♀ ( <i>hipp.</i> ) Jan. 25 "
16	"	♀ Jan. 25 "
17	"	♀ ( <i>pluv.</i> ) Jan. 25 "
18	"	♀ ( <i>hipp.</i> ) Jan. 25, 3 p.m.
19	"	♀ ( <i>hipp.</i> ) Jan. 25 before dawn
20	Jan. 10	♀ Jan. 27 at dawn
21	"	♀ Jan. 27 "
22	Jan. 12	♀ ( <i>hipp.</i> ) Jan. 28 before dawn.

" Pupation usually occurred between 6-10 a.m. and the imago emerged in great majority of cases before or at day-break."

#### *Papers.*

The following papers were read :

" On the relationship between certain West African Insects, especially Ants, Lepidoptera and Homoptera," by W. A. LAMBOURN, M.R.C.S., L.R.C.P., F.E.S., Entomologist to the

Agricultural Department of Southern Nigeria. With an Appendix containing descriptions of New Species by G. T. BETHUNE-BAKER, Pres. Ent. Soc.; W. L. DISTANT, J. HARTLEY DURRANT, and Prof. R. NEWSTEAD, F.R.S.

"Supplementary notes on new or little-known forms of *Acraea*," by H. ELTRINGHAM, M.A., F.Z.S. With description of a new form of *Acraea everdon* by Prof. E. B. POULTON, D.Sc., F.R.S.

Prof. POT LTON, in giving an account of Mr. W. A. Lamborn's paper, stated that it contained careful observations on the association between three species of Liptenine *Lygeniidae* and particular species of ants, and recorded facts from which such an association could be inferred in three other species. The same association was described, often in great detail, between seventeen species of *Lygeniinae* and their respective ants. Eight species of *Lygeniasthes* (s.l.) were included among these. The paper also contained an account of the habits of several carnivorous Lepidopterous larvae, including some of the *Lygeniidae* which fed upon ant-tended Homoptera.

Careful observations upon the life-history of the *Membracidae* and their association with ants were also put on record. An important appendix, in which the new species and genera are described, was contributed by Mr. G. T. BETHUNE-BAKER, Pres. Ent. Soc., Mr. W. L. DISTANT, Mr. J. HARTLEY DURRANT, and Prof. R. NEWSTEAD, F.R.S.

### Wednesday, October 1st, 1913.

Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in the Chair.

#### *Election of a Fellow.*

Herr WILHELM JUNK, 68, Sachsische-strasse, Berlin, W. 15, was elected a Fellow of the Society.

*Exhibitions.*

**HAPLOTHORAX BURCHELLI.** MR. H. F. BARTLETT exhibited a specimen of the Carabid beetle *Haplothorax burchelli* found under a stone on the lower part of Flagstaff Hill, St. Helena, on March 25, 1913. A party of three were looking for this insect on Deadwood Plain and Flagstaff Hill, given by Wollaston as its habitat, but though a large number of remains were found, the ♂ exhibited was the only one seen alive in a hunt of about an hour.

Prof. POULTON observed that the type specimen in the Hope Department was also in good condition—though W. J. Burchell's St. Helena collection from which it had come had perished—since Mr. Hope had (fortunately) forgotten to send it back.

**LARVAL AND IMAGINAL EMBIIDAE FROM TUNISIA AND ALGERIA.** MR. P. A. BUXTON exhibited specimens (sp. as yet undetermined) from various localities in Tunis and Algeria and from the coast to south of the Atlas Mountains. They were never common, and always found as larvae in small communities (rarely singly, and once a score together) under stones and fallen leaves of prickly pear—never under bark; all the individuals of a community faced in the same direction and retreated or advanced down their tubes with equal ease backwards or forwards. The exhibited larvae (two) came from Hammam Meskoutine, Constantine, E. Algeria (30 March, 1913). Their food was doubtful. The insects (originally six) had lived in the same tube from March to September. No cast skins were found nor dead individuals, which must therefore have been eaten. They refused to touch a fly, alive or dead, also a blade of grass. They made a large chamber in a piece of cork in their tube, with three small entrances to it, but the gutter to which of cork cannot be high. The insects spun. Key-tube in all directions in their home, commencing by a strong spiracle five inches long, which was spun by six Embiids in ten days. In nature the tubes branch dichotomously, and are flattened in cross section. The chamber in the cork was not silk-lined. The insects were very shy and skototropic, and very sensitive to vibration. They were

taken to Norway, and probably fed unsuitably, and developed slowly in a perfectly dry tube.

The adult male exhibited was bred by Mr. C. B. Williams from a larva brought by the exhibitor from El Kantara (just S. of the Atlas range). This was kept rooking wet between two pieces of bark in a beaker, and had developed much more quickly. The food was again doubtful; it had had Psocids and mildew as well as bark in its beaker. It had been kept warm in a greenhouse.

HEMIPTERA-HETEROPTERA STILL PRESERVING CHARACTERISTIC SMELL AFTER A LAPSE OF EIGHTY-FIVE YEARS. — Mr. Buxton also brought a drawer of mixed *Heteroptera* (Pentatomids, etc.) given to a relation of his who died in 1830. The drawer still smelt strongly of bugs, quite differently from any other drawer in the same collection.

REMARKABLE COLEOPTEROUS PALPI. Mr. E. E. Green exhibited a Drilid (?) beetle, from Ambalangoda, Ceylon, with remarkable elongate spatulate mandibular and maxillary palpi.

BRACONID SILK. Mr. W. J. Lucas exhibited, on behalf of Mr. G. T. Lyle, some silk wound from a Braconid cocoon, together with specimens of the cocoons themselves. Mr. Lyle had written as follows :

"Many species of *Braconidae*, or rather their larvae, are known to form silken cocoons in which a period of from eight days to eleven months is passed, according to the species and season. One of the largest of these to be found in Britain is *Meteorus albiditarsis*, Curtis, which is parasite upon the larvae of various species of Noctuids, and whose cocoon is generally, if not always, formed underground, within that of its host.

"A certain resemblance which this cocoon possesses in shape, texture and colour to that of the silkworm of commerce, *Bombyx mori*, led me to believe that its silk might be wound off in a similar manner. This I found to be quite easy, and by employing the same methods as I did when a small boy with the silkworm cocoons, I obtained the skein of silk which is exhibited to-night. The silk would appear to be somewhat finer than that of the silkworm, but even if superior in quality,



the smallness of the yield and difficulties in breeding the maker render it more than unlikely that it will ever become of commercial importance."

CONIOPTERYGID COCOONS.- Mr. C. B. WILLIAMS exhibited specimens of the cocoons of the three British *Coniopterygidae*: *Coniopteryx tineiformis* on a pine needle, *Semidalis aleuradiiformis* in a small depression in a hawthorn twig, and *Concentrica psociformis* on the under-side of holly leaves. The cocoon of the latter species is a double structure having an outer layer some distance above the small inside case which contains the pupa.

In answer to a question by Mr. E. E. GREEN, Mr. Williams replied that the larvae had eaten ova, particularly those of spiders, and also mites, and small scale insects.

MIMICRY IN RELATION TO GEOGRAPHICAL DISTRIBUTION.  
-Dr. F. A. DIXEY exhibited several boxes of Lepidoptera in illustration of the geographical relations of Mimicry, and remarked on them as follows:

The theory of Mimicry, like many other theories, is by no means so simple as it looks at first sight. I propose to restrict my remarks on this occasion to one aspect only of the question, viz. its relation to the facts of geographical distribution.

It is well known to all entomologists that along with the striking resemblances between insects of different affinities which are considered to come under the head of Mimicry, there exists to a large extent a community of habitat.

Take, for instance, the group of red, black and white Neotropical butterflies, allied to our English Swallowtail, of which *Papilio polydon*, Godt., is a good example. This particular colour scheme has representatives in each of the three sections into which the genus naturally falls; and the same scheme is adopted by a number of butterflies, such as *Euterpe rosacea*, Butl., which have nothing to do with the Swallowtails, but are nearly allied to our common garden whites. This particular combination of colours is unknown except in Central and South America.

So also the peculiar faces of the genus *Mylothris*, with the parallel series of forms presented by the very distinct genus *Phassant*, belongs exclusively to the African Islands and Continent south of the Sahara.

In both of these cases, and in many others that might be adduced, the dependence of resemblance on locality extends further than to the general aspect of an assemblage of species common to the whole region. It is found that where modifications of the pattern occur in different parts of the same extended region, the whole number of insects associated by participation in the common pattern undergoes the same kind of change; they all become similarly modified together. One of the most striking instances of this phenomenon is afforded by a well-known assemblage of butterflies from Central and South America which has been fully dealt with by Prof. Poulton. These butterflies are characterised by a peculiar arrangement of the colours red, yellow and black; and the assemblage contains representatives of many different subfamilies, including Ithomiines, Heliconiines, Danaines, Nymphalines and Pierines, to say nothing of certain moths. The general facies, while retaining its common elements, shows certain modifications according to the special locality; one such modification being peculiar to Central America, another to Venezuela, and others to Trinidad, Guiana, East Brazil, the Upper Amazon and Ecuador. These modifications, be it understood, are not confined to one or two of the constituent members of the combination, but are shared in by all or most of the associated species. A somewhat similar phenomenon may be observed in the parallel African genera *Mylothris* and *Phrissura* which were mentioned just now. Both of these are Pierine genera, though the affinity between them is not very close.

In considering such cases as these, the number of which might be almost indefinitely extended, we are naturally inclined to ask whether the geographical conditions may not have something to do with the resemblances noted. No doubt they have; but the question remains whether such influence is a direct or an indirect one. That the influence of a climatic condition may sometimes be direct is suggested by the temperature experiments of many investigators, including Merrifield, Standfuss and Fischer. But there are great, and, as it would seem, insurmountable difficulties in the way of adopting the hypothesis of a direct climatic or geographical

cause for such cases as those that have been mentioned. This has been shown so convincingly by Prof. Poulton, that I need not enlarge on the point further than to remark that a general lightening or darkening of pigment, as in some experimental cases, is an entirely different matter from the production of an elaborate colour-pattern like that, for example, of the female of *Perrhybris pyrrha* and its Ithomiine and Heli-coniine counterparts.

But, it may be asked, if the theory of a direct action of the environment be given up, what explanation remains? Well, the hypothesis of mimicry remains. This rationalises the geographical facts, without raising the difficulties involved in the theory of direct action. I will not attempt to recapitulate the arguments in favour of the mimetic explanation, but for my present purpose will assume that it is, at all events provisionally, accepted.

This being so, it will not escape the notice of those who inquire into the facts, that there are some anomalies that require further explanation. It is, for example, sometimes found to be the case that a supposed mimic is observed in regions where its model is not known to occur. This may in certain instances be due to the ascertained fact that many insects, including butterflies, do occasionally extend their range, occupying districts where they were previously unknown. In the case of a Batesian mimic, such a proceeding would presumably be hazardous in the extreme, and the species could hardly be expected to establish itself in its new home unless it succeeded in developing some fresh means of defence. In the case of a Müllerian mimic, the difficulty would be lessened.

But in seeking an explanation of such cases there is another factor to be taken into account; viz. the distribution of enemies. It is quite conceivable that a migratory bird, for instance, which had learned its lesson in one locality, might carry its experience into another region; and in this way the mimic might still retain some measure of the protection originally gained in the presence of its model. An interesting example, possibly explicable on these lines, has been adduced by Prof. Poulton. An hypothesis of this kind naturally

needs to be verified before it can take rank as a true explanation.

Some would explain all supposed cases of mimicry as being merely the result of coincidence. In the midst of so wide a range of facts it is to be expected that coincidences should be found; and as a matter of fact they do occur under circumstances which put explanation by the principle of mimicry out of the question. There is a numerous assemblage in South America characterised by a white diagonal band crossing the fore-wing, the general surface of both wings being of a dark colour. To this assemblage belong many species of diverse families of both butterflies and moths. The following are here exhibited :—

#### DARK GROUND-COLOUR WITH WHITE DIAGONAL BAND.

##### AMERICA.

##### NYMPHALINAE.

- Catonephele capenas*,  
Hew. ♀.  
*Ectima rectifascia*, Butl.  
*Ectima licia*, Fabr.  
*Eunica europa*, Cram. ♀.  
*Eunica sophonisba*, Cram.  
♀.  
*Adelpha epione*, Godt.  
*Phyciodes*, sp.

##### SATYRINAE.

- Lasiophila prosymna*,  
Hew.  
*Pedaliodes pucestas*,  
Hew.

##### ACRAELINAE.

- Actinote hylonome*, Doubl.  
♀.

##### ERYCINIDAE.

- Mesosemia merania*, Hew.  
*Mesosemia asa*, Hew. ♀.

##### HEPERIIDAE.

- Bungalotis astylos*, Cram.  
*Nascus broteas*, Cram. ♀.  
*Telegonus apastus*, Cram.  
*Thymele enotrus*, Cram.  
*Orses cynisca*, Swains.  
*Spathilepia clannius*,  
Cram.  
*Cecropterus neis*, Hübn.  
♂.  
*Cecropterus neis*, Hübn.  
♀.  
*Cecropterus annus*, Fabr.  
*Cecropterus itylus*, Hübn.

##### SYNTOMIDAE.

- Ctenucha circe*, Stoll.  
*Ctenucha braganza*, Sehs.

<i>Euagra latera</i> , Druce.	<i>Heterusia</i> , sp.
<i>Agyrta porphyria</i> , Stoll.	and others.

## GEOMETRIDÆ.

*Leucopsumis*, sp.  
*Sangala*, sp.

## HYPSIDÆ.

*Eucyane pylotis*, Dru.

Those who admit the theory of Mimicry at all will probably allow that between some of these forms at all events, the relation is a mimetic one. But when we turn to the Old World, we find several species, also of diverse affinities, exhibiting very much the same type of pattern, which at once suggests a warning signal, or, to use Prof. Poulton's convenient term, an aposeme. Examples are here shown from Asia, Australasia and Africa.

## ASIA.

## ERYCINIDÆ.

*Dodona ovida*, Hew. ♀.  
*Abisara neophron*, Hew.

## HESPERIIDÆ.

*Charmion ficulnea*, Hew.

## LYMANTRIADÆ.

*Numenes silheti*, Wlk. ♀.

## GEOMETRIDÆ.

*Odezia aterrima*, Butl.

## CHALCOSIINÆ.

*Pidorus glaucopis*, Dru.

♂.

*Pidorus glaucopis*, Dru.

♀.

## HESPERIIDÆ.

*Casyapa dissimilis*.  
 Swinh.  
*Plesioneura feisthamelii*,  
 Boisd.

## GEOMETRIDÆ.

*Heleona remota*, Wlk.  
*Craspedosis norbeata*.  
 Swinh.

## NOCTUIDÆ.

*Leucanitis schraderei*, Feld.

## AFRICA.

## ZYGAENIDÆ.

*Pithecia perspicua*, Linn.

## AUSTRALASIA.

## ERYCINIDÆ.

*Abisara segesica*, Hew.

## PYRALIDÆ.

A specimen unidentified.

Here again it will probably be allowed by believers in the theory of Mimicry that there is a mimetic relation between some at least of these Old-World forms. But that the Eastern

aposeme should so closely resemble the Western must be put down to coincidence; and we shall perhaps not be far wrong if we suppose that a simple, but no doubt effectual, aposeme like this may originate quite independently in regions far remote from each other, and may become the common property of many diverse species.

What has been said of the white band aposeme will also apply to a second case, in which the white of the band is replaced by brown or orange, as is shown by the examples here exhibited. These are as follows:—

#### DARK GROUND-COLOUR WITH BROWN OR ORANGE DIAGONAL BAND.

##### AMERICA.

##### BRASSOLINAE.

- Brassolis sophorae*, Linn.  
*Opsiphanes crameri*, Fld.

##### HELICONINAE.

1. *Opisogynis*.  
*Heliconius melpomene*  
*melpomenides*, Riff.  
2. *Opsiorhynchi*.  
*Heliconius hydarus*  
*hydarus*, Hew.

- Catagramma pacifica*,  
Bates.

- Catagramma brome*,  
Boisd.  
*Catagramma atacama*,  
Hew.  
*Catagramma aerias*,  
Godm. and Salv.  
*Callithea sapphira*,  
Hübner.

##### SATYRINAE.

- Daedalus dinias*, Hew.

##### NYMPHALINAE.

- Chlorippe vacuna*, Godt.  
♀.  
*Adelpha sophax*, Godm.  
and Salv.  
*Adelpha melanippe*,  
Godm. and Salv.  
*Epiphile oreia*, Hübner.  
*Cyclogramma pandama*,  
Doubt. and Hew.  
*Catagramma denina*,  
Hew.

##### ERYCINIDAE.

- Erycina inca*, Saund. ♂.  
*Erycina inca*, Saund. ♀.  
*Emesis cypria*, Feld. ♀.  
*Panara phereclus*, Linn.  
♂.  
*Panara phereclus*, Linn.  
♀.  
*Aricoris jansoni*, Butl.  
*Aricoris*, sp.  
*Isapis agyrtus*, Cram.

<i>GEOMETRIDAE.</i>	<i>Cleis sakuni</i> , Horsf.
<i>Nelo uxisama</i> , Druce.	<i>AUSTRALASIA.</i>
<i>Nelo pandia</i> , Druce.	
<i>Nelo</i> , sp.	<i>ERYCINIDAE.</i>
<i>Darma colorata</i> , Wlk.	<i>Abisara statira</i> , Hew.
<i>HESPERIIDAE.</i>	<i>ARCTIADAE.</i>
<i>Mahotis nurscia</i> , Swains.	<i>Buzara chrysomela</i> , Wlk.
<i>Lychnuchus celsus</i> , Fabr.	♀.
<i>Lychnuchoides ozias</i> , Hew.	<i>AGARISTIDAE.</i>
<i>ASIA.</i>	<i>Immetalia saturata</i> ,
<i>HESPERIIDAE.</i>	Wlk. ♂.
<i>Koruthaialos</i> , sp.	<i>Scrobigeria semperi</i> , Feld.
<i>Koruthaialos rubecula</i> ,	<i>LYMANTRIADAE.</i>
Plotz.	<i>Orygia josiata</i> , Wlk. ♂.
<i>Koruthaialos xanites</i> ,	<i>GEOMETRIDAE.</i>
Butl.	<i>Milionia glauca</i> , Cram.
<i>Kerana cameroni</i> , Dist.	<i>Milionia cyaneifera</i> , Wlk.
<i>Kerana armatus</i> , Druce.	<i>CALLIDULIDAE.</i>
<i>GEOMETRIDAE.</i>	<i>Cleis sobah</i> , Pagenst.
<i>Milionia pulchrinervis</i> ,	<i>AFRICA.</i>
Feld.	<i>HESPERIIDAE.</i>
<i>CALLIDULIDAE.</i>	<i>Pardaleodes fan</i> , Holl.
<i>Callidula attenuata</i> ,	
Moore.	

In another series of forms the aposeme consists of a dark ground-colour crossed by a band of varying shades of yellow. This also is found in both hemispheres, East and West, and to it the same considerations are no doubt applicable.

#### DARK GROUND-COLOUR WITH YELLOW OR YELLOWISH WHITE DIAGONAL BAND.

<i>AMERICA.</i>	<i>NYMPHALINAE.</i>
<i>PAPILIONIDAE.</i>	<i>Catonephele esite</i> , Feld. ♀.
<i>Papilio androgeus laodocus</i> , Fabr. ♀.	<i>Hypna clytemnestra</i> ,
	Cram.

<i>Gynaecia dirce</i> , Linn.	<i>HYPSIDAE</i> .
	A species undetermined.
<i>ACRAEINAE</i> .	<i>CASTNIIDAE</i> .
<i>Actinote nox</i> , Bates ♀.	<i>Castnia pelagius</i> , Feld.
<i>HESPERIIDAE</i> .	ASIA.
<i>Cecropterus zonilis</i> , Mab.	<i>ERYCINIDAE</i> .
<i>Cecropterus rectilucis</i> , Butl.	<i>Abisara fylla</i> , Westw. ♂.
<i>Rhabdoides cellus</i> , Boisd.	<i>Abisara fylla</i> , Westw. ♀.
<i>AGARISTIDAE</i> .	<i>CALLIDULIDAE</i> .
<i>Phasis mardava</i> , Druce.	<i>Callidula erycinoides</i> , Wlk.
<i>Phasis noctilux</i> , Wlk.	<i>CHALCOSINAE</i> .
<i>Othria columbina</i> , Westw.	<i>Pidorus gemina</i> , Wlk.
<i>Othria amazonica</i> , Westw.	AUSTRALASIA.
<i>SYNTOMIDAE</i> .	<i>AGARISTIDAE</i> .
<i>Episcepsis melanitis</i> , Hüb. n.	<i>Phalaenoides glyciniae</i> , Lewin.
<i>Histiaca tina</i> , Boisd.	<i>Eutrichopidia latina</i> , Don.
<i>Callopepla emarginata</i> , Wlk.	<i>NOCTUIDAE</i> .
<i>GEOMETRIDAE</i> .	<i>Idalina affinis</i> , Boisd.
<i>Sagaris</i> , sp.	<i>HYPSIDAE</i> .
<i>Sagaris horeae</i> , Druce.	<i>Hypsa versicolor</i> , Fabr.
<i>Ephialtes basalis</i> , Hüb. n.	AFRICA.
<i>Ephialtes tryma</i> , Schaus.	<i>AGARISTIDAE</i> .
<i>Ephialtes dilatata</i> , Wlk.	<i>Rothia simyra</i> , Westw.
<i>Ephialtes erinnys</i> , Geyer.	<i>HYPSIDAE</i> .
<i>Gelta elite</i> , Wlk.	<i>Caryatis syntomina</i> , Butl.

Some one will say: "If you attribute so much to mere coincidence, are you not furnishing to this extent an argument against the theory of Mimicry?" I reply, "No: these are simply the exceptions that prove the rule." It is quite true that some of these Old-World forms, if they occurred alongside of the Western forms which they resemble, would probably



be claimed as mimics of the Western models, or *vice versa*; and it is equally true that the facts of geographical distribution make such a claim impossible. But what we have to notice is that in all these cases the aposeme is of an extremely simple character, such as might well arise quite independently in different geographical regions. When we come to patterns of a more complicated kind, such for instance as that of the red, white and black Papilios, or the red, black and yellow Ithomiines and Heliconiines, the case is entirely altered. I cannot exhibit New and Old-World series of these, corresponding to those you have just seen of the simple white or coloured band, for the reason that such series do not exist. The conclusion is obvious: if mere coincidence can account for the coexistence of so many forms showing the same pattern in a given locality, why cannot it produce the same or a similar pattern elsewhere? This we have seen it can only do if the pattern is relatively simple. A complicated system of colouring is beyond the power of mere coincidence to reproduce. We are therefore driven back to the position that geographical conditions are at the bottom of the matter; and if, as seems indisputable, the direct influence of the geographical environment must be disallowed as a cause, we can only conclude that the influence is indirect. And of possible indirect causes the only one yet suggested which appears to be at all adequate is mimicry.

If it be true that there is no rule without an exception, I ought perhaps to be challenged to show some exceptions to the rule I laid down just now about a complicated mimetic pattern being confined to one definite region of the earth's surface. Here are a few such:—

*Gybelis mnasybus*, Doubl. and Hew., a South American Nymphaline, resembles *Hypolimnas bolina*, Lin., ♂, a Nymphaline from Asia. *Megalura marcella*, Feld. ♂, another Neotropical Nymphaline, is like a magnified *Marmessus bois-duvalii*, Moore, an Indian Lycaenid. A South American Hyspid, *Eucyane egaensis*, is strikingly resembled by *Milionia fulgida*, Voll., a Geometrid from Java. It is quite likely that if these Old-World forms occurred in company with the New-World species put beside them, they would be

accounted as belonging to the same mimetic association. But although I can bring forward a few instances of this nature, they remain few, isolated and insignificant. They may, in my judgment, be confidently reckoned as some of the exceptions which prove, or test, the rule.

Prof. POULTON and Dr. JORDAN both concurred as to the meaning to be assigned to the instances cited by Dr. DIXEY.

PAPILIO DARDANUS, BROWN, BRED IN S.E. RHODESIA BY MR. C. F. M. SWYNNERTON.—Prof. POULTON read the following extract from a letter written from Chirinda, S.E. Rhodesia, Aug. 28, 1913, by Mr. C. F. M. SWYNNERTON :—

"You will have received my postcards of the past few mails and been interested in the consistent way in which your expectations have been fulfilled.

"Emergences have taken place since last mail from a 2nd brood of *cenea* parentage and one of *trophonius* parentage. There are relatively few pupae left, and it may be interesting to sum up the results as they now stand :—

"*Hippocoon* ♀ parent : many families : ♀ offspring always *hippocoon*.

"*Cenea* ♀ parent : two families : ♀ offspring *hippocoon*, intermediate and *cenea*.

"*Trophonius* ♀ parent : one family : ♀ offspring only 3, viz. 2 *hippocoon* and 1 *trophonius*.

"*Niobe* ♀ parent : one family : ♀ offspring *hippocoon*, *niobe* and intermediate between *niobe* and *cenea*.

"The families are small, the result not only of early losses but of the damage to pupae, through the muslin, by my ground hornbills. I did not realise the extent of these latter losses till I finally moved the pupae from the sleeves to boxes. The damage has resulted sometimes in non-emergence, sometimes in deformity. It is especially a pity in the families of *niobe* and *cenea*, as these were producing interesting intermediate forms. However, the main point to be tested has come out pretty clearly, and in accordance with your expectations."

Prof. POULTON said that Mr. Swynnerton's breeding experiments showed that the *hippocoon* form at Chirinda in S.E. Rhodesia is, genetically, just as predominant as the *cenea*

form is in the Durban district. His results furthermore showed, as the speaker had anticipated, that the proportion of the ♀ forms to be observed in any locality was a safe criterion of the proportion that will be obtained by breeding. It was particularly interesting to find so marked a contrast between localities not more distant than S.E. Rhodesia is from Natal. Mr. Swynnerton would be sailing for England in October, and it was therefore to be hoped that the whole of this material would be shown by him to the Society later in the present year or early in 1914.

AN IMPORTED JAPANESE LOCUSTID.—Mr. W. J. LUCAS exhibited, on behalf of Dr. Burr, a specimen of *Diestrammena marmorata*, Haan, a Stenopelmatic Locustid from Japan, which occurs alive in Relf's Nursery at St. Leonards; (v. Ent. Rec. for Sept. 1913, p. 228). The insect is carnivorous.

ARASCHNIA LEVANA IN THE FOREST OF DEAN.—Mr. H. ROWLAND-BROWN brought for exhibition an example of *Araschnia levana*, sent him by Mr. T. Butt Ekins of Penarth, who said that he had captured it at the end of May this year on the outskirts of the Forest of Dean, close to the banks of the Wye, where there is an abundance of undergrowth, including nettle. The example was a female in good condition; this was the first reported authentic capture of the species in a wild state in the United Kingdom.

AN ABERRATION OF COLIAS EDUSA.—Comm. J. J. WALKER exhibited a ♀ *Colias edusa*, F., taken by himself in the Isle of Sheppey, August 21, 1913, in which the margin of the hind-wings was almost entirely clear golden yellow, the usual black border being reduced to three or four spots; the yellow markings in the border of the fore-wings were also much extended.

AN IMPORTED AMERICAN SYNTOMID.—Comm. WALKER also exhibited a specimen of a Syntomid moth, a *Ceramidia* near *C. chloroplegia*, Druce, taken by a lady in a fruiterer's shop in North Oxford, evidently just emerged from the pupa, and brought alive to the exhibitor September 18, 1913. It had no doubt been imported with fruit, probably bananas.

SCARCE AND ABERRANT COLEOPTERA.—Comm. WALKER also exhibited the following Coleoptera:—

(1) A short series of the very rare Halticid beetle *Psylliodes cyanoptera*, Ill., taken in June 1913, at Wood Walton Fen, Hunts, on *Sisymbrium sophia*, by Mr. W. Holland.

(2) A specimen of *Coccinella 10-punctata*, L., var. *confuens*, Haw., taken in the Isle of Sheppey, June 1912, and another very curious aberration of the same beetle with golden yellow spots from Wytham Park, Berks, July 30th, 1913.

(3) The very rare ♂ of *Malthodes atomus*, Thoms., also from Wytham Park, June 14th, 1913.

(4) A monstrosity of *Haliphus confinis*, Steph., with three perfectly developed tarsi on the right-hind leg, received from Mr. W. Holland, and taken by him at Wood Walton Fen, near Ramsey, Hunts.

Mr. P. A. BUXTON observed that *Sisymbrium sophia* was supposed not to grow now in Wood Walton Fen, and the Hon. N. C. ROTHSCHILD said that this was the case in the fen itself, but that he had found it just outside.

A COLLECTION OF CATOCALIDS.—Mr. DADD exhibited an interesting collection of Catocalids, comprising most of the Continental species.

Mr. DURRANT exhibited on behalf of Mrs. W. C. Boyd a series of specimens of British Lepidoptera of great historical interest which she is presenting to the British Museum (Nat. Hist.). Mrs. Boyd desired that these specimens should be exhibited to the Society before being incorporated in the national collection.

*Chariclea delphinii*, L.

Chelsea, 1799, captured in his garden in the summer of 1799 by W. Jones. British record—*teste* Donovan, N.H. Br. Ins. X., 18 (1801); Haworth, Tr. Ent. Soc. Lond. I., 35 (1807); Barrett, Lp. Br. Is. VI., 145-6 (1900). From W. Jones Coll. it passed to Druitt Coll.; Druitt presented it to J. N. Winter, from whom it passed to Coll. W. C. Boyd—*vide* W. C. Boyd, Ent. Mo. Mag. XXXIX., 281 (1903).

*Torula quadrifaria*, Sulz.

(*Psodos alpinata*, S.-D., Stph. Ill. Br. Ent. Haust. III., 144 (1831); Wd. Ind. Ent. 450; *equestrata*, F., Crt. Br. Ent. IX., 424 (1832).

A reputed British specimen, ex Coll. W. Jones, Chelsea, whence it passed to Druitt Coll.; Druitt presented it to J. N. Winter, from whom it passed to Coll. W. C. Boyd.

*Diasemia ramburialis*, Gn.

Probus, Cornwall, 16. VI. 1858 (*T. Boyd*). British record—*T. Boyd*, Ent. Wk. Int. IV., 151 (1858); Stainton, Ent. Ann. 1859, 149 Pf. 3.

*Ebulea catalaunalis*, Dp.

Cheshunt, Herts, 18. IX. 1867, in the garden (*W. C. Boyd*). British record—still unique, *W. C. Boyd*, Ent. Mo. Mag. IV., 152-3 (1867); Knaggs, Ent. Ann. 1868, 108-9 Pf. 4.

*Platyptilia zetterstedtii*, Z.

Lynmouth, N. Devon, VII. 1855 (*T. Boyd*). British record—Stainton, Ent. Ann. 1856, 44.

*Gelechia ocellatella*, Boyd.

Lizard, Cornwall, taken, and bred from *Beta maritima*, V. 1858 (*T. Boyd*). New species—*T. Boyd*, Ent. Wk. Int., IV., 143 (1858); Stainton, Ent. Ann. 1859, 151 (1858); Durrant, Ent. Mo. Mag. XXXI., 82-4 (1895).

*Gelechia arundinetella*, Boyd.

River Lea, near Hackney, larva *Carex riparia*, IV-VI. ex. 22, VI. 1857 (*T. Boyd*). New species—*T. Boyd*, Ent. Wk. Int. II., 139-40 (1857); Stainton, Ent. Ann. 1858, 91: N.H. Tin. X., 226.

*Gelechia leucomelanella*, Z.

Lizard, Cornwall, larva *Silene maritima*, 18, V. 1858 (*T. Boyd*). British record—*T. Boyd*, Ent. Wk. Int. IV., 143 (1858); Stainton, Ent. Ann. 1859, 150-1.

*Glyphipteryx fischeriella*, Z. (= *schoenicolella*, Boyd).

Lizard, Cornwall, taken, and bred from *Schoenus nigricans*, V. 1858 (*T. Boyd*). British record—(Type series of *schoenicolella*)—*T. Boyd*, Ent. Wk. Int. IV., 144 (1858); Stainton, Ent. Ann. 1859, 153.

*Coleophora limosipennella*, Hb.

Sutton, bred from Elm leaves, 1854 (*T. Boyd*). British

record—Stainton, Ent. Comp. 133 : Ent. Ann. 1855, 45 (2nd ed. 67).

*Nepticula prunetorum*, Stn.

Loudwater, Bucks, bred from *Prunus*, 1854 (*T. Boyd*).  
New species—Stainton, Ent. Ann. 1855, 50 (2nd ed. 72).

*Nepticula atricollis*, Stn.

Bred from wild Apple, and Hawthorn, 1856 (*T. Boyd*).  
New species—Stainton, Ent. Ann. 1857, 112.

*Nepticula luteella*, Stn.

Bred from Birch, 1856 (*T. Boyd*). New species—Stainton,  
Ent. Ann. 1857, 110.

*Nepticula minusculella*, HS.

Cheshunt, Herts, bred from Pear leaves, 22. II. 1869 (*W. C. Boyd*). British record—*W. C. Boyd*, Ent. Mo. Mag. V., 280 (1869).

ABERRATIONS OF LEPIDOPTERA FROM THE GUILDFORD DISTRICT.—Mr. H. O. HOLFORD exhibited a specimen of *Coenonympha pamphilus* of abnormally large size, taken at Newlands Corner, and a ♀ of *Ematurga atomaria*, almost without markings, from Milford.

BUTTERFLIES FROM THE TYROL.—Mr. D. PEARSON showed a drawer of butterflies taken this summer in the Tyrol, including specimens of the large Tyrolean form of *Polyommatus amandus*, and a series of *Erebia euryale* var. *ocellaris*.

A short discussion arose as to the specific identity or otherwise of *E. ligea* and *E. euryale* in which Dr. CHAPMAN and Messrs. WHEELER, DADD, and ROWLAND-BROWN took part, but no definite conclusion was reached.

#### *Papers.*

The following papers were read :—

"Illustrations of Specific Differences in the Saws of Female Dolerids," by Rev. F. D. MORICE, M.A., F.E.S.

"Additions and Corrections to my List of the *Rhopalocera* of Trinidad (1904)," by W. J. KAYE, F.E.S.

"On the Urticating Properties of *Porthesia similis*," by H. ELTRINGHAM, M.A., F.E.S.

Wednesday, October 15th, 1913.

Rev. F. D. MORICE, M.A., Vice-President, in the Chair.

*Election of Fellows.*

The following gentlemen were elected Fellows of the Society :—Messrs. EDWARD O. ARMITAGE, Geelong, Victoria, Australia; F. W. CRAGG, M.D., Capt. I.M.S., King Institute of Preventive Medicine, Saidapet, Madras; WALTER JAMES DOW, The Cottage, Lynwood Avenue, Epsom; LESLIE JOHN WILLIAM NEWMAN, Dept. of Agriculture, Perth, W. Australia.

*Title of the Society.*

As there had been no meeting of the Council since the last reply had been received from the Privy Council Office as to the title of the Society, it was unanimously resolved to postpone any discussion which might have taken place at the present meeting to the next.

*Exhibitions.*

THE EVOLUTION AND DISTRIBUTION OF ASYMMETRICAL INDO-AUSTRALIAN PASSALIDAE.—Mr. F. H. GRAVELY, who was present as a visitor, exhibited lantern slides illustrating the evolution of asymmetrical from symmetrical forms of Indo-Australian *Passalidae*. He pointed out that the anterior margin of the head, the mandibles, and the labrum, all showed a tendency towards asymmetry in the groups dealt with, but not in certain other groups living under apparently the same conditions in the same place. Further, the degree of asymmetry found in the mandibles was always correlated with the degree of asymmetry found in the anterior margin of the head. The manner of evolution of this asymmetry could be traced right from the start in forms still living, and was different in different sub-groups, proving that asymmetry had originated independently in each of them, and that the degree of asymmetry found in any species of *Passalidae* might be regarded as an index of the degree of specialisation to which that species had attained.

It was therefore interesting to find that the most primitive

(symmetrical) genera of what might be termed the Australian (in a broad sense) asymmetrical group, were confined, with the exception of a single species, to Australia (in a restricted sense), and that no asymmetrical species was known from there; while the most primitive (symmetrical) genus of what might be called the Oriental asymmetrical group, was confined to Ceylon: these primitive genera being much more alike than were their more highly specialised representatives in intermediate localities.

It appeared, therefore, that we had here an example of discontinuous distribution, due to the pushing outwards of primitive forms by their more highly specialised descendants. This was especially well shown in the Oriental asymmetrical group, a group confined to the Oriental Region, and including all asymmetrical forms found there except those belonging to the genera *Gonatas*, Kaup, *Graphalocnemis*, Heller, and two small genera closely allied to the latter. The symmetrical genus *Episphenus*, Kaup, was confined to Ceylon, the dominant species in which island belonged to the slightly asymmetrical genus *Chilomazus*, Lang. In the Indian Peninsula the group was represented only by two species of the more highly asymmetrical genus *Basilianus*, Kaup. The degree of asymmetry exhibited by these two species was at least equalled by that of every asymmetrical species of the group found in the remainder of the Oriental Region, where the dominant species was *Aceraius grandis*, Burmeister, the most highly asymmetrical form known. A small symmetrical genus, allied to *Episphenus* but off the main line of evolution, had, however, succeeded in establishing itself in the hills of Assam and in the Eastern Himalayas.

A considerable discussion took place on this exhibit with regard to the occurrence and possible use of asymmetry, in which Prof. POULTON, Mr. CHAMPION, Rev. F. D. MORICE and other Fellows took part; Dr. DIXEY instancing the cases of the Narwhal and of certain Crustaceans, Mr. E. E. GREEN some species of Termites, and Mr. KAYE the male genitalia in many Sphingids; Mr. GAHAN pointed out the undoubted utility of asymmetry in the mandibles of many insects, the teeth of the one side fitting into the grooves of the other,



while Mr. BLAIR observed that it was not necessarily an indication of high specialisation, since it was found in some very primitive insects. In answer to a question from Mr. CHAMPION, who said that in his experience of Tenebrionid beetles asymmetry of the mandibles was confined to the ♂♂, Mr. GRAVELY replied that in the Passalids of which he had been speaking it was equally present in both sexes.

A NEW GENUS OF MYMARIDAE.—Mr. F. ENOCK exhibited photographs of the ♂ and ♀ of a new Mymarid, and read the following note :—

During a short holiday at Hastings, I had the good fortune in sweeping to obtain an entirely new Mymarid, at Hollington Wood, near Hastings. After a long examination under the microscope, I failed to identify it with any of the known genera. On submitting the specimens, of which I obtained a male and female, to Mr. Chas. O. Waterhouse, he confirmed my opinion that I had captured something quite new, which we determined to name *Neurotes iridescens*. It is closely allied to Haliday's genus *Limacis*, and we have placed it at the head of the British *Mymaridae*.

Mr. C. O. WATERHOUSE corroborated Mr. Enock's remarks and observed that the new genus was nearer to the Chalcids than any of the previously known Mymarids.

RARE MYRMECOPHILOUS DIPTERA.—Mr. DONISTHORPE exhibited specimens of the rare myrmecophilous Diptera :—

1. *Platyphora lubbocki*, Verrall, two specimens bred out of his observation nest of *Formica sanguinea* on July 11 and 26 last. Only two specimens have been captured (one by Dr. Wood in Herefordshire and the other by Mr. King in the New Forest) since Lord Avebury bred a specimen in an ant's nest. He expressed his opinion that his two specimens had hatched from pupae of *F. fusca* given to the *sanguinea* colony as slaves.

2. *Aenigmatias blattoides*, Meinert. A specimen of this curious little apterous Dipteron was taken in a nest of *F. fusca* at Nethy Bridge, July 21. It was originally taken by Meinert in a nest of *F. fusca* in Denmark. Subsequently Wasmann had bred a few specimens from *F. fusca* pupae in his nests, in Luxemburg.

3. *Peyerimhoffia brachyptera*, Kieff., taken in a nest of *Lasius alienus* on Lundy Island, June 9. He added that only two specimens had been taken heretofore, by Mons. Peyerimhoff under a stone, in Algeria.

SCOTCH ZYGAENIDS.—The Hon. N. CHARLES ROTHSCHILD exhibited specimens of *Zygaena filipendulae* from the Isle of Lismore, Scotland, and an example resembling them from Folkestone.

Mr. L. W. NEWMAN observed that he had exhibited to the Society some years ago a *Zygaenid* from Oban similar to those exhibited by the Hon. N. C. Rothschild, and that he believed it to be a separate species.

CHRY SOPHANUS DISPAR, VAR. RUTILUS.—Mr. ROTHSCHILD also exhibited specimens of *Chrysophanus dispar*, var. *rutilus* from Hungary and other localities, and made remarks on the different races. The exhibitor said that in his opinion specimens of the first brood from this Hungarian locality equalled in size all but the abnormally large examples of the British insects. He stated that if the insect is bred in England from ova deposited by a female sent to this country in the late summer, the butterflies emerge far later than they do in Hungary.

CHRY SOPHANUS DISPAR, VAR. RUTILUS, AND FORMS OF AGRIADES CORIDON.—Mr. H. ROWLAND-BROWN brought for exhibition examples of *Chrysophanus dispar*, var. *rutilus* captured by him in the marshes of the Gironde below Bordeaux on August 1st and 2nd, 1911, to compare with the much larger form taken in Hungary by Mr. N. C. Rothschild. He said that examples of the first generation, taken on the same ground in May, 1912, by Mr. F. Gilliat, were no larger than those of the second emergence, nor did they present any marked superficial differences.

He also exhibited a specimen of *Agriades coridon*, var. *titonus*, Meig. (= *syngrapha*, Kef.), taken in the Chiltern Hills on August 9th, 1913, being the first ever recorded therefrom; with several examples of this variety taken by him at Dom-pierre-sur-Mer, Charente-Inférieure, on August 4th and 5th, 1911; and an example of the form *semisyngrapha*, Tutt, taken by Dr. J. N. Keynes at Royston, Herts; and for comparison

the form of the ♀ commonly taken in the Chilterns, having the basal area of the hind-wings rayed with blue; also, a fine ♀ of the form of *coridon* which occurred with *rutilus* in the Gironde, on the marshes themselves, and entirely away from chalk, or limestone formation.

**GYNANDROMORPHOUS GONEPTERYX CLEOPATRA.**—Capt. E. B. PUREFOY exhibited a short series of *G. cleopatra* which included two gynandromorphous specimens. The parents came from abroad in 1908, and the brood had been kept up in Kent ever since. He said that the ♀♀ paired before hibernation, and that this was the most important factor making for success.

Dr. LONGSTAFF inquired whether Capt. Purefoy had noticed the scent of the ♂ and ♀ of *G. cleopatra*, and observed what an exceptional opportunity he had of doing so. He had been unable to distinguish some ♀♀ of *G. cleopatra* from those of *G. rhamni*, but the scent might possibly differ. If the scent of the ♂ were connected with the orange suffusion, those specimens in which there was but very little orange should have very little scent.

The Rev. G. WHEELER pointed out that the ♀♀ of these two species might be distinguished by the underside of the fore-wings, those of *G. cleopatra* having a slight orange suffusion along the median nervure.

Mr. F. ESOCK said that he had sent several pupae of *G. rhamni* to a young collector, from one of which a ♂ had emerged with unusually large orange spots. These specimens had been attacked on the setting board by ants, which had eaten out the orange spots only.

Prof. PORTON said that ants were known previously to eat out only the scent-patches on certain African butterflies.

**SMERINTHUS POPULI.**—Mr. L. W. NEWMAN exhibited four gynandromorphous specimens of *Smerinthus populi*, three with the left side ♀ and right side ♂, and one *vice versa*. In three of the specimens there was no trace of variation in the wings either in size or markings, the antennae only denoting gynandromorphism. The fourth specimen showed well the two sexes, the left side being smaller and quite differently marked from the right. He also showed two extreme light,

two extreme dark, two light pink and two dark pink *Smerinthus populi*, bred from selected parents.

AGRIADES CORIDON.—Mr. NEWMAN also exhibited four curious ♀ specimens of *A. coridon*, three having the right pair of wings much smaller than the left and heavily dusted with blue scales, the left side being normal; also one specimen similar but *vice versa*. All were taken wild in Herts in 1913, where several other similar specimens were noticed.

AN IRISH PTEROSTICHUS ATERRIMUS.—Dr. G. W. NICHOLSON showed a specimen of *Pterostichus aterrimus*, Pk., from Cloverhill, Co. Cavan. The only other Irish record is from the Co. Cork, where a few were taken in the early thirties of the last century. This species used to be common in the Fens before they were drained, but has since disappeared from there. A specimen, however, was taken in Norfolk by Prof. Beare in 1911.

ABERRATION OF TELCHINIA VIOLAE.—Mr. E. E. GREEN exhibited a transfer of a remarkable aberration of *Telchinia violae*, Fab., taken by Mr. G. Halkett, in the district of Kurunegala, Ceylon. He also showed transfers of the normal form of the same butterfly which is usually regarded as a very constant species. The aberration consists of a black suffusion completely occupying the cell of the fore-wing; a considerable extension of the discal black spots; a suppression of the pale spots on the black border of the hind-wing, together with an inward extension of the black border along the course of the veins.

PARASITISED JASSIDAE.—Mr. GREEN also exhibited *Jassidae* from Ceylon, parasitised by an undetermined species of *Gonatopus*.

ACANTHOCINUS AEDILIS FROM BOW.—The Rev. G. WHEELER exhibited on behalf of Miss Macbride a number of living specimens of the Longicorn beetle *Acanthocinus aedilis*, L., taken in a timber-yard at Bow. This species is almost confined in the British Isles to Scotland, being far from uncommon in the neighbourhood of Rannoch, but has been several times brought south in timber, and has been taken in the British Museum itself. Only the ♂ has antennae of the immense length of the specimens exhibited.

BUTTERFLIES FROM THE SUDAN.—Dr. LONGSTAFF exhibited on behalf of Mrs. Waterfield a box of Sudanese Pierine Butterflies taken by her, and communicated her observations thereon, viz. :—

The following notes give a short account of some of the butterflies that I have taken during the last three winters in the neighbourhood of Port Sudan. This newly-opened port of the Anglo-Egyptian Sudan is situated, roughly speaking, half-way down the African coast of the Red Sea, and about 35 miles north of the older and better-known Port of Suakin.

Port Sudan is situated on a creek in the fringing coral reef which forms a beautiful natural harbour. Its surroundings are almost entirely devoid of vegetation except for a few thorny acacia trees and such desert plants as can subsist on the thin layer of salt earth which covers the old coral reef. Where, however, a stream finds its way to the sea, there the conditions are improved, and a variety of plants will grow on the soil brought down from the hills about 16 miles distant. It is in these watercourses—locally termed “khors”—which are dry except for a few days in the year, and in the public gardens, a plot of land enclosed in the middle of the town, that my entomological studies have been made.

During the winter months rain falls every few weeks, sometimes to the extent of 2" or more, and it is after rain that the butterflies emerge in numbers. I have not spent a longer time in the Sudan than from November to May, so have had no opportunity of studying insect life during the summer.

1. *Belenois mesentina*, Cr. At times this insect is very common, and I have bred it in numbers from larvae taken on a bright green-leaved shrub of which the green exactly matches the green along the caterpillar's back. The black and white chrysalis is also frequently to be met with, and I think the caterpillar must feed on various shrubs. The females seem to be particularly sluggish, and can often be caught in the fingers as they sit with folded wings on flower or leaf.

2. *Syn. hloë glauconome*, Klug. This butterfly I overlooked until Dr. Longstaff pointed it out to me. In 1912 it was common in the public gardens. In 1913 I saw it plentifully once only, when riding in the desert, but a few days later

a visit to the spot with a net yielded but a solitary specimen. It seems to frequent the driest and most barren places.

3. *Herpaenia lacteipennis*, Butl. This insect I have only once taken, and then the brood was obviously almost over. The four tattered specimens I took were flying in a broad and, for the time, grassy "khor," where there was a variety of vegetation.

4. *Calopteryx eulimene*, Klug. I was surprised to find this considered a rare insect, as it is to me one of the most widely distributed species that I take. In fact, wherever the wild caper bush grows there will this most beautiful little insect almost certainly occur. In a freshly caught specimen the red veins on the underside of the lower wings are heavily outlined in green, but in a worn specimen hardly a trace of green will be left. The female has no pink sheen to the yellow tips of the fore-wings.

5. *Teracolus phisadia*, Godart, I have only taken once, at Sinkat, the hill station about 72 miles from Port Sudan, where it was almost the only insect to be found; it was flying round plants of what I took to be a sort of creeping cactus (possibly *Vitis quadrangularis*, Wallich).

6. *Teracolus chrysonome*, Klug. This is common enough in some "khors" near Port Sudan, though I have never taken it in the public gardens. It seems to go on continuously, never swarming, but always to be found throughout the winter months.

7. *Teracolus protomedia*, Klug. In 1912 this was a common insect, and in spite of being very difficult to catch, I brought home a fair series. This year I never saw it, though why I never knew.

8. *Teracolus halimede*, Klug. This insect seems to be moderately common throughout the winter. When chased it has a habit of flying straight through the nearest thorn bush, so that the ragged creature which emerges on the other side has earned its own freedom. The female seems rarer than the male.

9. *Teracolus pleione*, Klug. This charming little insect was scarce in the winter of 1911, quite common in 1912, but

altogether absent in 1913. I think I know the food-plant, which seemed to be growing as strongly as ever.

10. *Teracolus eris*, Klug. In 1912 I took one in very poor condition in a garden near our house and quite away from the desert. The next specimen I saw was in my breeding-cage, where it emerged from the chrysalis of a small green larva which I had unwittingly brought home on the food-plant of *B. mesentina*. I found four more larvae, and two eggs which hatched, and the caterpillars from them were almost full grown when ants got into the cage and devoured them and other treasures. The egg was clear except for an irregular red line running round it: it was laid on the upper side of the leaf. The caterpillar was green, wood-louse shaped, and hard to see, as it generally lay along the midrib of the leaf.

11. *Teracolus eupompe*, Klug. In 1912 this very lovely insect was quite common, but in 1913 I took only a couple of males, though I was constantly on the look out for it. It is a species that varies very much as to size, and the female has a great tendency to vary in the amount of red at the tips of the wings; often this is quite absent, but the underside appears to be always characteristic.

12. *Teracolus achine*, Cram., is never abundant, but in the course of an afternoon's hunt two or three specimens will come to hand. I have taken it more commonly at Suakin than at Port Sudan.

13. *Teracolus दौरa*, Klug. This inconspicuous little butterfly, so far as I know, is only taken in one spot on the bank of a "khor" near Port Sudan, where it sits in the rough grass, seldom apparently flying much.

14. *Teracolus liagore*, Klug, is another butterfly favouring tufts of grass near "khors." It is a rare insect, and one pair in an afternoon is the largest number I have taken at a time.

15. *Teracolus evarne*, Klug, is the common butterfly of the place. Every winter I have found it abundantly. From a long series one may pick out small and pale examples known as *philippsi*, Butl. I have tried to breed this species from eggs laid in captivity, but the infant larvae refused to eat. The egg was straw-coloured at first, then vermillion, and hatched on the fourth day.

16. *Catopsilia florella*, Fabr., is another insect which was fairly common in 1912 but quite absent in 1913. Being a strong-flying butterfly it is hard to catch. The males seem decidedly more common than the females, and also easier to catch.

17. *Colias hyale*, auct., var. *marnoana*, Rogenh. This butterfly is generally to be found in grassy places, though not always abundantly. The pale variety of the female would appear to be the commoner.

AMAUROS EGIALEA STROKING THE BRANDS OF THE HIND-WINGS WITH ITS ANAL TUFTS, AGAIN OBSERVED BY W. A. LAMBORN.—Prof. POULTON said that he had just received a letter written Sept. 19-23, 1913, from Mr. W. A. Lamborn, who was now resident, as Entomologist to the Agricultural Department of Southern Nigeria, at Moor Plantation, Ibadan. The letter contains the following interesting observation dated Sept. 20 :—

"I saw this morning a male *Amauris egialea*, Cram., settled on a leaf in the sun, brushing its scent-patches with the anal tufts, the abdomen being anteflexed. The wings were midway between the vertical and horizontal positions, and at the end of each act of brushing they were suddenly brought almost together and then expanded to the original position."

Mr. Lamborn's earlier observation on the same species, made Jan. 30, 1912 (Proc. Ent. Soc. 1912, p. xxxv), states that the wings were "over-flexed," their outer margins being in contact with the leaf and therefore below the general level of the body. The difference in attitude was an interesting one, and might perhaps be explained by the use of the scent-organ at different periods in the life of the imago or in different states of physiological activity. The sudden movement of the wings suggested that the object was to promote the passage of scent from within or between the secreting cells into the cups on the surface of the brand, as described and figured by Mr. Eltringham, on Plate XX of this year's Transactions. Again, it was possible that the motion promoted the circulation of fluids in the neighbourhood of the veins, or of air in the tracheal tubes of the wing. That the motion bore some relation to the function of the scent-brand could hardly be doubted.



Prof. POULTON said that in view of Mr. Eltringham's researches on *Amauris niavius*, L., he wished now to withdraw the suggestion that scent was conveyed from the brushes to the brands (Proc. Ent. Soc., 1911, pp. xlv, xlvii). It was obviously more probable that scent secreted in the brands was conveyed to the brushes.

Mr. Lamborn had now three times observed the brushing of the brands by male Danaines, and, as far as Prof. Poulton was aware, no other naturalist had ever seen this operation, although it was probably performed several times by all the males of many species which were among the commonest of tropical butterflies. He hoped that naturalists would now make a special point of watching male *Danaini* and *Euploeini*. It would be especially interesting to observe the insertion of the tufts into the pockets of certain *Danaini*, such as the species of *Tirumala* and *Danaida*, and in the *Euploeini* to ascertain whether the brands on the part of the hind-wing that is overlapped by the fore-, as well as those existing on the fore-wing itself, bore a similar relationship to the anal tufts. He much hoped that Oriental naturalists would settle this question for us.

MR. W. A. LAMBORN'S OBSERVATIONS ON THE COURTSHIP OF A LYCID BEETLE.—Prof. POULTON exhibited a set of four males and one female, and another of two males and one female, of *Metriorrhynchus semiflabellatus*, Thoms. Both sets were captured on *Urena lobata*, July 16, 1913, at Moor Plantation, near Ibadan, S. Nigeria. Of the first set Mr. Lamborn had written: "Two of these were *in coitu* and the other three were clinging to them"; of the second set: "Two beetles *in coitu*, the third, an unsuccessful suitor, clinging to the successful male." Prof. Poulton said that these observations might be compared with Mr. Lamborn's earlier record, in Proc. Ent. Soc., 1911, p. xcv, of three males of the *Acraeinae* butterfly *Planema alcinoe*. Felder, clinging to a female *in coitu* with a fourth male. The *Acraeinae* and the *Lycidae* were both distasteful groups with aposematic colours, and it was reasonable to suppose that the increased conspicuousness produced by such masses of individuals was not harmful to them as it would be to palatable species. Mr. C. J. Gahan had kindly determined the species.

A LIZARD ATTACKING *MEGACHILE CINCTA*, F.—Prof. POULTON exhibited a female specimen of *Megachile cincta*, the subject of the following note by Mr. W. A. Lamborn: "My attention was attracted to the nest under the eaves of a building at Moor Plantation at 2 p.m., June 5, 1913, by hearing the protesting buzz of a bee, and I then discovered a female *Agema colonorum* trying to get at a *Megachile cincta*, the hinder extremity of which was just appearing at the mouth of a cell. The lizard had only managed to nibble away a few wing fragments." The tip of the left fore-wing bore evident traces of the attack. Two males from the same nest, emerging Aug. 9-28, during Mr. Lamborn's absence, and Sept. 2, were also exhibited. The Hymenoptera of this and the following note were kindly determined or confirmed by Mr. G. Meade-Waldo.

INSECTS BRED BY W. A. LAMBORN FROM THE NESTS OF HYMENOPTERA ACULEATA.—The material of the following observations made at Moor Plantation was exhibited by Prof. POULTON:—

1. A male *Megachile cincta* (Sept. 17), and the Cantharid beetle *Zonitis eborina*, Fahr. (Sept. 17), the latter kindly named by Mr. K. G. Blair. The following note referred to the specimens: "A nest made by *Megachile* was found in an outhouse on June 5, 1913. A *Megachile* emerged on Sept. 17, and a bright pink beetle left the same cell on the same day, one or other having, I think, bored out sideways into this cell from another adjacent one. It is perhaps well to mention that the nest was placed on June 5 in a jar which was closed with a glass lid, and that since that date the cover has not been off."

2. *Odynerus* sp. inc. (Sept. 17): The species exists unnamed in the collection of the British Museum.—"A large mud nest, which I thought belonged to *Megachile*, was found in an outhouse July 24. A small wasp emerged on Sept. 17."

3. A female *Mutilla floralis*, Klug.—"This female Mutillid emerged July 26, from a mud nest, probably that of *Sceliphron spirifex*, L., found July 14."

4. *Chrysis* (*Tetrachrysis*) sp. inc. (July 26), *Chrysis* (*Tetrachrysis*) *lyncea*, F. (Aug. 3), and *Sceliphron spirifex*, L., ♀ (July 31). All three insects emerged at the recorded dates

from "mud nest of *S. spirifer*, found in my store July 20, 1913." The emergence of two species of Chrysid from the same nest was of special interest.

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### Wednesday, November 5th, 1913.

MR. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in the chair.

#### *Election of an Honorary Fellow.*

On the recommendation of the Council, DR. A. P. SEMENOFF TIAN-SHANSKI was elected an Honorary Fellow in the place of the late Prof. O. M. REUTER.

#### *Election of Fellows.*

The following gentlemen were elected Fellows of the Society:—Messesrs. HUGH WARREN BEDFORD, Church Felles, Horley; HAROLD S. CHEAVIN, F.R.M.S., F.N.P.S., Clematis House, Somerset Road, Huddersfield; CHARLES ALBAN WILLIAM DUFFIELD, Stowting Rectory, Hythe, and Wye College, Kent; W. EGMONT KIRBY, M.D., Hilden, 46 Sutton Court Road, Chiswick, W.; LOUIS MEADEN, Melbourne, Dyke Road, Preston, Brighton; F. V. BRUCE MILLER, Livingston, N. Rhodesia; ALEXANDER DAVID PEACOCK, 137 Wingrove Gardens, and Armstrong College, Newcastle-on-Tyne; H. ANANTHASWAMY RAO, Curator of the Govt. Museum, Bangalore, India; PERCIVAL NATHAN WHITLEY, New College, Oxford, and Brankwood, Halifax.

#### *Title of the Society.*

The question of the change of title of the Society was opened for discussion from the chair, with a view to ascertaining whether there was a sufficiently strong feeling in favour of a change to justify the Council in calling a Special Meeting, but as the preponderance of feeling appeared to be

somewhat against any change, it was announced that the Council would take no official action on the matter, it being open to any six Fellows to require a Special Meeting if they so desired.

*Wicken Fen.*

The PRESIDENT brought before the meeting the necessity of forming a fund for the care of that portion of Wicken Fen left by the late Mr. G. H. Verrall to the National Trust, and at his request the Hon. N. C. Rothschild and Mr. H. Rowland-Brown addressed the meeting on the subject. Mr. Rowland-Brown, at the President's desire, expressed his readiness to act as Treasurer for any subscriptions given by Fellows of the Society. It was added that the question of the possibility of the Society's contributing, as such, would be brought before the next meeting of the Council.

*Exhibitions.*

THAIS RUMINA AS A PROTECTED SPECIES.—DR. G. B. LONG-STAFF exhibited a series of 17 *Thais rumina*, Linn. (including a ♀ of the var. *canteneri*, Feld.), taken in March 1913 at Ronda, in Andalusia, where the species is common. He called attention to the fact that this beautiful but familiar S. European butterfly is conspicuously coloured, with the striking pattern much alike on the two surfaces, that its flight is very slow and fearless, that it is difficult to kill by pinching, and further that it has a very persistent peculiar odour of a musty character with a suggestion of the scent of the pepper-tree. These characters taken together are highly suggestive of a distasteful butterfly.

PANORPA COGNATA, RAMB.—MR. W. J. LUCAS exhibited three species of *Panorpa*, and communicated the following note :—" On Oct. 1 Col. J. W. Yerbury gave me a dragon-fly and three Neuroptera which he took during the summer in Wales. One of these, which I exhibit, is a female of the scarce Scorpion-fly *Panorpa cognata*. It was captured at Llangammarch Wells on August 23. I once took a specimen, also a female, at Byfleet in Surrey. Besides these I know of but one or two other captures. There are, however, a few

British examples in older collections. For comparison I have put with it typical *Panorpa germanica*, L., and *Panorpa communis*, L."

LEPIDOPTERA FROM DEVONSHIRE.—Mr. H. LUPTON exhibited a specimen of *Thalpocharis ostrina*, taken in the middle of June 1913, about a mile from the coast and about four miles from Ilfracombe. Also two specimens of *Dianthoecia luteago*, var. *ficklini*, taken in the middle of the same month on the coast of N. Devon.

Comm. WALKER referred to Dr. Perkins' specimen of *T. ostrina*, taken on June 1 this year at Paignton, and exhibited at the meeting of the Society on June 4.

Mr. A. H. JONES said that he had always found it scarce and sporadic abroad, though he had taken it in various localities.

AN ADDITIONAL OBSERVATION ON THE COURTSHIP OF A S. NIGERIAN LYCID BEETLE BY MR. W. A. LAMBORN.—Prof. POULTON exhibited four males and one female of *Metriorrhynchus semiflabellatus*, Thoms., concerning which Mr. Lamborn had sent the following note. Prof. Poulton said that this record ought to have accompanied the observations communicated by him to the last meeting, but it had been inadvertently overlooked. "These beetles were noticed July 15, 1913, in a confused heap on the plant *Urena lobata*, L., (*Malvaceae*). On closer examination they were found to consist of a male and female *in coitu* and three unsuccessful suitors. The fortunate male was on the right side and rather beneath the female, maintaining himself in position by gripping the base of her second right tibia with his mandibles. A second male was resting on her right elytron, the edge of which he held in his jaws, and a third male sat on the second, supporting himself by gripping the base of the right antenna. The remaining male rested on the left elytron of the female holding on to its corrugations by his jaws. When there is no competition the male obtains admission to the female between her slightly separated elytra."

THE IMPORTANCE OF PRESERVING INSECTS FOUND IN COURT.—Dr. G. D. H. CARPENTER read the following notes in connection with his exhibit of *Epitoxis albicincta* :—Bates, in his original

paper describing mimicry in S. America, pays particular attention to the question of the perfect matching of two insects of a pair. Thus he says (Trans. Linn. Soc., vol. xxiii, p. 501): "The process of the creation of a new species I believe to be accelerated in the *Ithomae* and allied genera by the strong tendency of insects, when pairing, to select none but their exact counterparts," and again, on p. 513 he says: "... the one exact counterfeit, whose exactness, it must be added, is henceforward kept up to the mark by the insect pairing necessarily with its exact counterpart."

Charles Darwin (as Prof. Poulton pointed out in his Presidential address to the Ent. Soc., 1904) at once saw the importance of this, and wrote to Bates in 1862 ("Life and Letters," vol. ii, p. 392): "I wish, however, you had enlarged a little more on the pairing of similar varieties; a rather more numerous body of facts seems here wanted." Again on November 25 (1862?) he wrote: "Could you find me some place, . . . where you could state, as fully as your materials permit, all the facts about similar varieties pairing,—at a guess how many you caught, and how many now in your collection? I look at this fact as very important." Subsequently, Charles Darwin rather severely criticised the statements of Bates above alluded to. At the close of his review of Bates' paper in the Natural History Review for April 1863, article 17, pp. 223, 224, he says: "We will only notice briefly one other point which has an important bearing on the production of new species and races; namely the statement repeatedly made that in certain cases the individuals of the same variety evince a strong predilection to pair together. We do not wish to dispute this statement; . . . But we are by our profession as critics bound to be sceptical, and we think that Mr. Bates ought to have given far more copious evidence." I am much obliged to Prof. Poulton for telling me of this interesting passage.

Prof. Poulton, in his address mentioned above, quotes a letter from Trimen on this subject, who says: "I have noticed the tendency of sexes of a variety to pair together rather than with other varieties in the numerous cases of captured pairs sent to me by correspondents in South Africa, and sometimes

in cases of the same kind which occurred to myself when collecting."

Prof. Poulton remarks: "It is tantalising to reflect upon the number of interesting and important questions which could be now decided if" the practice of collecting and carefully labelling all specimens captured *in coitâ* "had prevailed during the past fifty years."

I now bring forward a few facts bearing on the question of the preferential mating of varieties, not because it is considered that sufficient evidence has been produced to prove anything, but rather with a view of directing more attention to this important point. On Bugalla Island, L. Victoria, during 1912, I found that a small and extremely variable Syntomid moth, *Epitoxis albicincta*, Hmps., was very abundant; I had previously met with this species at Jinja in Usoga, on the mainland, and at Mpumu in Chagwe, but not in such abundance as on the island. The moth varies equally in either sex, from a form all black without markings to a form with large and well-defined white spots. The first specimen I took was one of the fully spotted forms, on a grass stem (for it is always found in open grassy places) on Mpumu Hill, Chagwe. It hung feet upwards from a bending stem, and, when approached, held its wings in a peculiarly twisted way, hanging perpendicularly from its back but with the ventral surface facing forwards. I have obtained altogether 58 specimens in various localities, of which 22 were actually *in coitâ*. These can be arranged under six types, but of course no one type can be quite sharply marked off from another.

Before making any remarks upon the specimens grouped as on p. xci, it must be said that they were not collected altogether as they came. It will be seen, for instance, that Type VI comes mostly from the mainland; and although my impression is that it *was* relatively more abundant on the mainland, more material is required. For when I got on to the island I remembered that I had already caught Type VI on the mainland, and devoted myself rather to getting a good series of varieties than to determining the relative frequency of each. It is also suggestive, that Type I does not seem to





have been taken on the mainland. The localities were as follows:—

B. = Bugalla Island.

Jg. = Jinja neighbourhood, on the Uganda side of the lake inlet.

Jk. = " " on the Kerinya peninsula.

Js. = " " on the Usoga side of the lake inlet.

M. = Mpumu hill, Chagwe, about 20 miles from Kampala.

SHOWING THE MATCHING OF INDIVIDUALS OF ELEVEN PAIRS  
TAKEN IN COITU.

Pair Data.	Type I.	Type II.	Type III.	Type IV.	Type V.	Type VI.
1. B. 14.1.'12.		♂				♀
2. B. 7.12.'12.	♂				♀	
3. B. 20.9.'12.	♂			♀		
4. B. 11.1.'12.	♂			♀		
5. B. 16-30.9.'12.	♂			♀		
6. M. —. 7.'10.						♂
7. B. 15.9.'12.*		♂ ♀				♀
8. B. 15.9.'12.*	♂ ♀	♀				
9. B. 15.8.'12.			♂	♀		
10. B. 15.9.'12.*				♂	♀	
11. B. 1-15.9.'12.						

The above arrangement shows that while pairs Nos. 1, 2, 3, 4, 5 are not very well matched, pairs Nos. 6, 7, 8, 9, 10, 11 are excellently well matched.

In two instances the individuals are separated by three types (1st and 2nd pairs).

In three instances the individuals are separated by two types (3rd, 4th. and 5th pairs).

In three instances the individuals are of adjacent types (8th, 10th, and 11th pairs).

In three instances the individuals are of the same type (6th, 7th, and 9th pairs).

A particularly suggestive fact is that pairs Nos. 7, 8, 10 should have matched so well, seeing that they were all taken

\* The three pairs 7, 8, 10 were taken within a few yards of each other at the same time and date.

together. Instead of ♂ 10 uniting with either of the ♀♀ 7 or 8, he was *in coitû* with the one of the three which most nearly resembled himself.

It is obvious that my material is not enough to do more than suggest the interest that could be got from a large collection of hundreds of specimens made without prejudice, both of single specimens and of pairs *in coitû*. This species is an ideal one for such a collection, it is conspicuous and easily caught, it occurs in numbers in suitable open grassy places, and the pairs are easily seen *in coitû* on grass stems. Moreover, it is small, and yet well marked. Had we such a collection we could estimate mathematically the chances of one type pairing with its own rather than with another, according to the relative abundance of the different types; and then we should soon see whether the pairing was according to mathematical chances, or by selection.

In this connection it is interesting to note that on Bugalla Island on Jan. 14, 1912, specimens of every type were taken, and a single pair taken on that day was the worst matched of all my pairs!

This just shows how much we want a large amount of material from one locality. It may be said How can one moth select another of a pattern like itself? Even if it can see the pattern of its mate it does not know what its own pattern is like. It must be, if there is anything in the sexual selection amongst varieties, a problem of the same nature as Why does one individual know that another of the same species is its proper mate? It seems probable that the answer is, in the case of the little Syntomid we are discussing, that *scent* has much to do with it, and that variation in pattern is correlated with variation in scent. A lucky observation which I made on Bugalla Island, Oct. 25, 1912, has some bearing on this matter. A male moth, of the species we are discussing (*Epitoxis albicincta*), was sitting on a grass stem perfectly quiet and unconcerned, but a male *Acraea terpsichore*, L., form *ventura*, Hew., in a state of great sexual excitement, was endeavouring by every means in its power to effect coitus, frantically passing the tip of its abdomen round about the abdomen of the moth in every direction, and obviously trying to pair. Both these specimens

are exhibited in the box, the *Acraea* next to the Syntomid, in Type I. The obvious explanation is that the ♂ Syntomid, by chance, had a scent corresponding to that of the ♀ *Acraea*, and that the ♂ *Acraea* had made a bad mistake!

Dr. CHAPMAN observed that in view of nine of the eleven pairs exhibited it would seem that the darker ♂ selected the lighter ♀.

VARIOUS INSECTS MOSTLY FROM AFRICA.—Dr. CARPENTER also exhibited a case of miscellaneous insects and communicated the following notes upon them:—

Variety of *Acraea acerata*, Hew. (*vinidia*, Hew.).—At Jinja, in Usoga, I caught on the Kerinya peninsula, in Feb. 1911, a male of this species which very closely resembles the male of *Acraea viviana*, Staud. The dark tawny orange of the typical *acerata* is replaced by a shade of yellow almost identical with the colour of the male *viviana*.

*Acraea mairessei*, Auriv., very resistant to cyanide fumes.—The typically aposematic insects seem to have extraordinary powers of resistance, not only to damage inflicted by enemies, but to other harmful influences. A specimen of *Acraea mairessei* surprised me by being even more resistant than other Acraeines to the fumes of a cyanide bottle which knocked over other butterflies in a minute or two; this specimen, caught in Chagwe, Uganda, near Mpumu Hill, July 13, 1910, was very little the worse after half an hour in the bottle.

At a later date, on the Sesse Islands, I wanted to preserve a couple of pupae of *Planema consanguinea arenaria*, E. M. Sharpe. I put them in a cyanide bottle one night, and next morning they were still active. I repeated this the next night with the same result.

*Amauris albimaculata*, Butl.; scent-brand eaten out (by ants?).—A male specimen which had been caught at Jinja, Usoga, in the second half of August, 1910, was found by Prof. Poulton when it arrived at the Hope Dept. to have been damaged, probably by ants, in a very interesting way. The strongly odoriferous brand in the (left) wing had been neatly eaten out, and nothing else had been touched. Similar instances of this have been given in Proc. Ent. Soc., 1907, p. x, where Prof. Poulton describes a specimen of *Amauris*

*egialea*, Cram., sent by Mr. H. S. Gladstone from near Lagos, in which both scent-brands had been eaten out cleanly and neatly; and again in the Proceedings for 1912, p. xxxv, a specimen of *Am. niavius*, L., received from Mr. Lamborn, near Lagos, in which the same thing was shown. In a note to the first case was quoted a passage from Prof. Meldola (Ann. Mag. Nat. Hist., Dec. 1882, p. 425) in which he pointed out that the scent patches are *sexual* characters and have nothing to do with producing the general distastefulness.

Notes on three species of *Hesperiidae*:—1. *Eretis perpaupera*, Holl.—A very small specimen of this was found at Jinja shortly after sunrise one morning on a leaf amongst grass. It was covered with dew drops, and in a curious attitude which one never sees when the species is alert. The fore-wings were held out at right-angles to the body, but the hind-wings were quite disconnected from them, and near to the body, so that there was a distinct gap left between the anterior margin of the hind-wing and the inner margin of the fore-wing.

2. *Baoris niveicornis*, Plötz.—Several *Hesperiidae*, believed to be of this species, were caught at Jinja. The ♂ only is remarkable for having the upper surface of the antennae of a brilliant shining white, and so conspicuous are these in the field that on one occasion at least my attention was drawn to the butterfly by the gleaming white antennae.

Prof. Poulton suggests that this is an epigamic colour, since the brilliant white is only on the *upper* surface of the *male* antennae. It is interesting to compare with this the shining white fore-legs of the ♂ *Eretis perpaupera*, which are quite conspicuous when the butterfly settles.

3. *Leptalina lepeletieri*, Latr.—This dark-brown skipper is without markings save for two very conspicuous (in the cabinet) pearly white and sharply marked, narrow stripes, on the under surface of the hind-wing, running from base to hind-margin. The most conspicuous one passes through the centre of the wing, the other nearer the anal margin, along which is a little of the same colour. This species I found at Jinja amongst long grass; its resting attitude was vertically on a stem, head upwards, so that the silvery

lines not only broke up the uniform ground-colour, but themselves harmonised with the dry silvery stems of the grass.

The Lymantriid *Laelia niobe*, Weym. (*thompsoni*, Druce).—This fine species I reared for the first time from larvae found on Damba Island and later on Bugalla Island. At the close of my stay on Bugalla I found alarva like those previously found, but it pupated while still quite small, and to my astonishment the moth was totally different from the former imagines. I put the case down, at the time, as one of synaposematic resemblance between larvae; but, when I examined the specimens at Oxford this summer, I found that all the large specimens which I bred first were *females*, and the little, very different, form from the same type of larva was a *male*. So that it seems that *Laelia niobe* is very markedly sexually dimorphic. I suggest that perhaps the female has been influenced by the extraordinarily abundant and conspicuous Syntomid moth *Meganachia sippia*, Plötz, and that it is perhaps synaposematic with it. Descriptions of this, and many other new larvae, are in course of preparation.

Resting attitude of *Antheua spurcata*, Walk. (*Notodontidae*).—A specimen was found resting on a leaf in full glare of the sun at Jinja on Jan. 2, 1911. The glistening yellow fore-wings were brought together over the back with their inner margins contiguous, but at the posterior end the darker yellow anal tuft of the body projected upwards between the hind-margins of the wings. The moth was very conspicuous and absolutely motionless.

Zygaenid moth mimicking *Acraea quirina*, F.—I show a specimen of a Zygaenid, *Staphylinochrous tenellula*, Holland, which with its thinly-scaled black-bordered red wings is an excellent mimic of *Acraea quirina*, F., with which it may be found in the forest, though I have sometimes seen the moth outside the forest flying over open grass land. The general appearance of the *Acraea* is particularly well brought out on the wing; the flight of the moth is the steady straight, rather laboured flight of many conspicuous moths.

The following cases illustrative of aposematic and procryptic coloration have been recorded in the October number of

"Bedrock" for this year, but I venture to bring them forward again as they are of some interest. First, aposemes.

*Rhodogastris leucoptera*, Hmps. (*Arctiidae*), found resting in an exposed position at Jinja, 1910. Its wings were of a pure, hard, shining white colour, but not very thickly scaled, so that, when they were brought together over the body of the moth, the abdomen, which was of a bright rose-pink, was distinctly visible. The thorax was pure white, spotted with black; the legs, which were freely displayed, were of the same bright rose as the abdomen. When the moth was disturbed, it separated its wings and spread out the legs so as to display the bright pink (a typical aposeme), and emitted from the thorax just behind the head a copious yellow froth, till a mass of yellow bubbles with a very strong acrid odour (and, I may add, taste) projected on each side. Such frothing is a very common method of defence by aposematic insects. The abundant and very conspicuous Hysid moth, *paetolicus*, gives out the same kind of froth when handled, and I have proved by offering it to moth-eating monkeys, that it is markedly distasteful, for they would never eat it.

A very beautiful example was again afforded by a large grasshopper of the family *Acridiidae* (*Dictyophorus* (*Petasia*) *laticincta*, Walker). It was a very heavy-bodied, slowly moving species of dull leaden-black colour, with very small tegmina and small incompletely covered wings of reddish colour; its large and fat abdomen had red marks on the sides.

One constantly sees this insect crawling slowly and heavily over grassland, and it is extremely conspicuous. It makes no attempt to get out of the way, and only feebly hops an inch or so if much interfered with. In short, it has all the characteristics of a typically protected insect.

In order to test whether it was really distasteful, I put one down in front of three young pet monkeys, who were constantly fed on grasshoppers, so that they would expect it to be good to eat, as they were accustomed to being given only edible grasshoppers and always got greatly excited when the box was produced. In this case, however, instead of at once snatching it, biting its head off, and then devouring it piecemeal, one of the monkeys caught hold of it and looked at it

with great interest; it was obviously something which it would be better to examine first. The monkey was a young one who had been in captivity from babyhood, so that it was highly probable that he had never seen anything like this before. While he held the grasshopper (which was of good size, being two inches long), it began to emit yellow, strongly smelling, acrid froth from the sides of the thorax, forcing it out by first distending the abdomen with air so as to show off the red markings on the sides, and then contracting the abdomen so strongly that the bubbles emerged from the thorax with a hissing sound audible several yards away. At the same time the red wings were prominently displayed.

The monkey was obviously very greatly interested in this very curious phenomenon, and tasted the froth. He clearly did not like it, but, as he could not believe that an insect given him by his master was not good to eat, he persisted in pulling it to pieces and tasting: eventually the dismembered insect lay on the ground. It was hardly possible to doubt from the monkey's behaviour that this conspicuous insect was highly distasteful, and that if he had been a wild monkey, able to select what food he would eat from out of a great abundance and had already met one of these markedly aposematic grasshoppers, he would not think it worth while to try another. The other two monkeys tasted and smelt at the remains, but would not eat them.

I now quote two examples of *Procrapsis*. The first was a species of *Cirphis*, a Noctuid allied to our English *Leucania*, which adopted an unusual attitude when at rest. It was found at Jinja, in 1910, amongst tall dry grass. On the upper side the wings are light brown; below, however, they are of a beautiful light silvery grey. The meaning of this is at once obvious when the moth is seen in its natural environment, where it adopts an attitude quite foreign to that of the majority of Noctuids. It hangs from a dry flower-spike of tall grass, with the wings brought together face to face over its back so that they hang down showing only the silvery underside, and the effect agrees extraordinarily well with the silvery grass-head. I repeatedly saw it take up this attitude when it had

been disturbed and had flown away to one grass-head after another.

This brings out well the importance of seeing insects in their natural surroundings, for in this case a peculiarity in colouring is at once seen to be correlated with a marked departure from the attitude usually adopted by that particular group of moths.

A very wonderful example of procryptic resemblance brought out by attitude was afforded by a Notodontid moth which I found on a leaf on one of the islands in L. Victoria (*Scalmicauda niveiplaga*, Hmps.). Only a single specimen of this species has been recorded hitherto, namely the type in the British Museum. It had such a perfect resemblance to a dead and rolled-up leaf that I had to look again and again, and almost to touch it, before I could satisfy myself that it was really a moth.

The fore-wings, of a light brown colour, were closely brought together along the back, hiding the hind-wings, so that the two inner margins, of a slightly darker hue than the rest of the wing, came together along the middle line and represented the midrib of a leaf. The continuation of this into the petiole was represented by a large, upstanding, slightly curved tuft of long hairs projecting from the top of the head.

The front of the head was very dark brown and represented exactly the dark shadow of the interior of a tube of rolled-up leaf. Strange though it may seem, this was the most realistic factor in the whole resemblance, and that which made it most difficult to realise that one was looking at a moth and not at a dead leaf.

The fore-wings were light brown with several lines on them of a darker hue running out from the apparent midrib to represent veins on the leaf, and there were three doubly ringed markings resembling the marks made by the growth of minute fungi on dead leaves. Near the tip was an absolutely pure white small round spot which quite well represented a gap at the edge of a dead leaf with high light shining through.

The antennae and legs were so carefully packed away that they were quite invisible.

I think I have never been so completely puzzled by an



insect resembling a dead leaf as by this moth, and yet when it had been set, and was in the Hope Museum, Prof. Poulton was surprised to hear how much like a leaf it had been when alive.

*Carabus violaceus*, L., attacked and forsaken by an enemy.-- This case was noted in "The Countryside" for June 24, 1905, but the date of the observation was previous to that, probably by several years.

I picked up, in the University Parks, at Oxford, a specimen of this beetle which had been badly mauled. The head had been removed at the junction with the thorax, and all the legs, except the right posterior one, had been removed at the base. The exception still had the femur attached to the body. The stumps of the legs were being vigorously moved. I took the specimen home, and it lived for three weeks and three days from the date on which I found it, being able to move the leg stumps up to the end of that time.

If this injury *was* due to an enemy, and not to mischief by some child, it illustrates remarkably the distastefulness of this beetle, which had been forsaken after many repeated tastings, and also the vitality which is such a characteristic feature of protected insects.

*Sphegidae* and *Pompilidae*, a remarkable difference in the methods adopted for filling up their burrows.--The very first Fossors which I observed were a Sphegid, *Amnophila hirsuta* (*viatica*. Sm.), Scop., and a Pompilid, *Pompilus cicatens*. L., at Bordighera on the Italian Riviera, in the early spring of 1899. The point I wish to emphasise is this: after the burrow has been stocked it has to be filled up. When it was necessary to ram the loose earth down, the Sphegid used its head: holding on to the sides of the burrow with all its legs it launched itself down against the loose earth, using the broad flat anterior surface of the head as a battering ram. The Pompilid, on the other hand, sat quietly over the hole, and rammed the loose earth down with the end of its abdomen. Since this remarkable difference was only seen in a single specimen of each, I was much interested when out in Uganda to be able to confirm it by observations on other species. *Sphex marginatus*, Smith, uses its head as does the other species

alluded to. *Pompilus bretoni*, Gués., however, employs its abdomen like *Pompilus viaticus*, and a species of *Salix* did the same. The *Salix*, however, showed another difference. All the other fossors which I have seen at work filled up the burrow by standing an inch or so away and scratching a shower of sand backwards in a continuous stream beneath the body; varying this by carrying small stones, etc., in their mandibles and ramming them in. *Salix*, however, adopted a much lazier method. It stood with its abdomen inside the burrow, and head and fore-legs projecting outwards, and simply reached out its armsful of the loose earth with its front limbs, which was then rammed down with the end of the abdomen as indicated.

It would be extremely interesting to know if other observers have noted this striking difference between Pompilids and Sphegids in methods of doing the same thing.

On one occasion, when watching *Ammophila hirsuta* (Scop.) at work at Bordighera in 1899, I by chance observed a very remarkable fact which is I believe unique. This species stores up a single caterpillar of species of *Noctuidae*, which it finds among the bases of grass stems in March when it hunts. I repeatedly saw it bringing to, and burying in its hole, these caterpillars. On one occasion when the egg had been laid as usual upon the 6th segment and the wasp was filling up the hole I frightened it away and brought out the larva, leaving it at the mouth of the hole. When the wasp came back and found the larva lying there it examined it and seemed puzzled, and then deliberately sucked the contents of the egg dry (I watched it shrivel!) and deposited another in its place.

This is a curious fact and suggests that the wasp's instinct led it to destroy the egg, which might well have been that of a species of indirect parasite whose larva would devour the food stored up for the wasp larva. I do not for one moment suggest that the wasp recognised the egg as such, otherwise it might equally well have known that it was its *own* egg!

A VERY RARE ANT.—Mr. DONISTHORPE exhibited ♂♂, winged ♀♀ and a dealated ♀ and ♂ of *Solenopsis fugax* Latr., taken at Blackgang, Isle of Wight, on Aug. 26, 1913. He mentioned that the colony was a very large one, and was not in connection with a nest of any other ant. The late Mr. Dale

appeared to be the only other person who had found the winged forms in this country. The ♂♂ and ♀♀ are much larger than the ♀♀, the latter being our smallest British ant. It is very rare and local in Britain, having only occurred at Deal, Southend, the Isle of Wight, and Portland.

ABERRATION OF PYRAMEIS INDICA.—Mr. E. E. GREEN exhibited an aberrant example of *Pyrameis* (*Vanessa*) *indica*, Herbst, from Ceylon. He remarked that the aberration was apparently caused by a sudden change of temperature at the critical period of pupation. A few full-fed larvae had been sent from Nuera Eliya (alt. 6,500 ft.) to Peradeniya (alt. 1,500 ft.), where they immediately pupated; of three specimens that emerged successfully, one was normal, while the other two had assumed the coloration of the example now exhibited. Though *P. indica* occurs in the plains, on the Indian continent, it is found only in the hills, in Ceylon. Its food-plant—the giant Nilgiri nettle—is more or less confined to the mountain region of Ceylon, though Trimen has recorded its occurrence at considerably lower elevations. This particular aberration of the butterfly has been figured in a recent number of “*Spolia Zeylanica*.”

CORYDALIS ORIENTALIS, McLACH.—Comm. J. J. WALKER exhibited a ♀ specimen of the gigantic Neuropteran, *Corydalis orientalis*, McLach., taken by a native collector at Chuchow, Chekiang Province, S.E. China, May 1913, and forwarded to the exhibitor by C. T. Bowring, Esq., F.E.S., of Wenchow. The species was described in Trans. Ent. Soc., 1899, pp. 281-3, plate ix, from a single mutilated specimen taken at Chia-tung-fu, W. China, by one of the late Mr. Leech's collectors. Species of *Corydalis* are numerous in North America, but only three (*C. asiatica*, Wood-Mason, from the Naga Hills, *C. orientalis*, McLach., and a doubtful species from Assam) have been recorded from the Old World.

ABERRANT AND HYBRID HETEROCERA.—Mr. L. W. NEWMAN exhibited the following Heterocera:—

(1) *Calymnia* (*Cosmia*) *trapezina*. A melanic ♀, the whole of the fore-wings very dark brown, with white transverse lines; a worn specimen taken at sugar in Bexley Woods.

(2) *Zonosoma* (*Ephyra*) *annulata* and *pendularia*; a long

and very varied series of both species, being picked forms from several thousands bred from ova. The specimens showed extreme light, dark, and intermediate forms and there was one very pink *Z. pendularia*.

(3) A series of Hybrid *Z. pendularia* ♀ and *annulata* ♂; specimens showing the markings of *pendularia* most pronounced and the coloration of *annulata* prominent.

#### *Papers.*

The following papers were read :—

"New or little-known *Heterocera* from Madagascar," by Sir G. H. KENRICK, Bart., F.E.S.

"The *Culicidae* of Australia," by FRANK H. TAYLOR, F.E.S.

"Descriptions of New Species of *Staphylinidae* from India," by MALCOLM CAMERON, M.B., R.N., F.E.S.

"*Pseudacraea eurytus hobleyi*, Neave, and its models on Bugalla Island, Lake Victoria, with other members of the same combination," by G. D. H. CARPENTER, B.A., M.D., F.E.S.

"*Pseudacraea boisduvali*, Doubl., and its models, with special reference to Bugalla Island," by the same.

"The inheritance of small variations in the pattern of *Papilio dardanus*, Brown," by the same.

The following is an abstract of these three papers on the bionomics of butterflies on Bugalla Island, L. Victoria.

The materials on which these papers are based was collected during 1912 and Jan.-Feb. 1913, on Bugalla Island, in the Sesse Archipelago in the N.W. corner of the great L. Victoria, about 25 miles S.W. of Entebbe, and a few miles S. of the equator, where I was working for the Royal Society's Sleeping Sickness commission. The specimens have all been presented to the Hope Department of the Oxford University Museum. The work has been done during the summer of this year while I was home on leave.

The first paper deals with the great *Planema-Pseudacraea* combination, and with other members of the same mimetic association, and a full description is given, for the first time, of all the varieties of *Pseudacraea eurytus*, Linn., so abundant on the island. The material on which it is based was collected,

as it came, without prejudice, and gives a fair idea of the relative abundance of the various forms.

The second paper was written with the idea of pointing out the great interest of the forms of *Pseudacraea boisduvali* on the island. This involved a careful study of all the specimens in the Hope Department, and, through the kindness of Mr. Roland Trimen, I was able to see his fine series. The Island forms are of the very greatest interest.

The third paper is to be considered somewhat as a reply to a recent statement by Prof. Punnett that in no case has it been clearly shown that small and unimportant variations are inherited. It is based on the *hippocoon* form of female of *P. dardanus*, and it is shown, by measurement of a particular spot (not one of the most important details in the mimetic likeness) that the pattern of a parent can influence a particular part of a different pattern in the offspring. A very large number of specimens was examined—all that exist in the Hope Department, together with a few of Mr. Roland Trimen's from a locality poorly represented at Oxford.

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### Wednesday, November 19th, 1913.

Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in the chair.

#### *Wicken Fen.*

Arising out of the Minutes, it was announced that the Council had decided to make an annual grant of two guineas towards the maintenance of Wicken Fen.

#### *Election of Fellows.*

The following gentlemen were elected Fellows of the Society :—Messrs. B. G. ADAMS, 15 Fernshaw Road, Chelsea; BARNARD ORMISTON DICKINSON, B.A., 57 Castelnau, Barnes, S.W.; ALFRED OLIVER ROWDEN, 3 Archibald Road, Exeter; OSCAR WHITTAKER, Ormidale, Ashlands, Ashton-upon-Mersey, Cheshire.

*Nomination of Officers and Council.*

The following Fellows were nominated by the Council as Officers and Council for next year :—*President*, Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S.; *Treasurer*, Mr. A. H. JONES; *Secretaries*, Commander J. J. WALKER, M.A., R.N., F.L.S., and Rev. G. WHEELER, M.A., F.Z.S.; *Librarian*, Mr. G. C. CHAMPION, A.L.S., F.Z.S.; *Other Members of the Council*, Messrs. E. A. BUTLER, B.A., B.Sc., J. E. COLLIN, S. EDWARDS, Dr. H. ELTRINGHAM, M.A., D.Sc., F.L.S., Messrs. C. J. GAHAN, M.A., A. E. GIBBS, F.L.S., F.Z.S., E. E. GREEN, G. MEADE-WALDO, M.A., Dr. G. W. NICHOLSON, M.A., M.D., Hon. N. C. ROTHSCHILD, M.A., F.L.S., F.Z.S., Messrs. H. ROWLAND-BROWN, M.A., and C. J. WAINWRIGHT.

*Exhibitions.*

SPANISH RHOPALOCERA.—Mr. A. H. JONES, in exhibiting specimens of both sexes of *Plebeius zephyrus*, var. *hesperica*, taken by him in June last at Albarracin, in Spain, remarked that this variety is hardly known in British collections. The butterfly is extremely local, and although specimens may be taken sporadically, it occurs chiefly among its food-plant, *Astragalus aragonensis*, or in its immediate vicinity. The size of the butterfly is smaller than *P. zephyrus*, var. *lycidas*, and the colour more resembles the blue, but perhaps not so bright, of *Polyommatus hylas*. The underside differs very little from that of *lycidas*. *P. zephyrus*, type, and var. *lycidas* were also exhibited for comparison. The larvae of the latter, as is well known, feeds on *Astragalus crocarpus*. Mr. Jones exhibited, also from Albarracin, in Spain, *Melitaea desfontainii*, var. *boetica*, Rbr., the Spanish form of *M. desfontainii*, Godt. (an Algerian butterfly): both sexes were exhibited. The butterfly is locally abundant, frequenting the hot dried-up watercourses, but probably the larvae feed on some plant on the hills beyond. Fresh specimens are extremely beautiful. The species is quite distinct from *M. aurinia*, but forms of that species and its var. *iberica* were also shown for comparison.

AN ABNORMAL PAIRING.—Mr. E. E. GREEN exhibited two Pierid butterflies, of distinct genera, taken *in coitū* at Aripu,

Ceylon. Copulation had been so complete that the two insects remained in the same position after death. It was possible that the structural differences in the sexual organs, while permitting the act of copulation, might have hindered the separation of the parts. The abnormal pair consists of *Appias libythea*, Fab., ♂, and *Teracolus limbatus*, Butl., ♀.

Dr. DIXEY, the Rev. G. WHEELER, and Dr. M. CAMERON commented on this exhibit, giving further instances of abnormal pairing.

VARIATION IN *HELICONIUS DORIS*, L.—Mr. W. J. KAYE exhibited a large and very variable series of *Heliconius doris*, L. He said that the species had always been an interesting one by reason of its curious phase of variation, which was usually one of dimorphism in both sexes. Both ♂ and ♀ were either blue or red-streaked in the hind-wing. In some localities, however, the red area was reduced or enlarged, but the blue form not only underwent this variation, but also became pale blue, bluish-green and green, such as was found in the region of Chiriqui in Panama. In the Cauca Valley in Colombia a very special phase of variation was found rarely, with both blue and red forms devoid of the large central yellow blotch, but occurring with normally blotched forms. In the San Esteban Valley in North Venezuela there occurred one of the rarest forms, that with the central blotch white. This phase occurred in both red and blue forms, but the former was considerably rarer, although both were very scarce. Occurring rarely in a number of localities, such as Venezuela, Colombia, Ecuador, Guiana, C. Brazil, was a form known as *amathusia*, where the blue and red streaking was mixed in varying degrees. The red form known as *delila*, which exhibited a large amount of red at the base of the fore-wing extending into the cell, was only found when other species of *Heliconius* had this characteristic such as in the Guianas, where *H. zanthocles*, *H. aede astydania* and *H. burneyi catharinae* all occurred together. The specimens exhibited were divided into the localities from whence they came, and included from British Guiana typical *doris* and *delila*; from Trinidad *doris* and *eratonia*; from Cauca Valley, Colombia, *eratonia*, *obscura*, *tecta*, *metharmina*, *aristomache*;

from C. Brazil a form of *amathusia* which was shortly blue-streaked with a few narrow red streaks through it; from Chiriqui the forms *viridis*, *luminosa*, *transiens*, and from the San Esteban Valley, N.W. Venezuela, a white blotched form of *eratonia* for which he proposed the name *suavior*, and a white blotched form of *metharmia* for which he proposed the name *fascinator*. Many other examples were exhibited from different localities. Mr. Kaye considered it was only confusing to say, as Riffarth and Stichel had done, that many of these forms split up into subspecies; while in several cases the statements could not be accepted as true. The form *tecta* was considered by them a form of the subspecies *H. doris viridis*, while *obscura* was treated as a form of the subspecies *H. doris doris*, yet both of these forms occurred together at Jimenez in W. Colombia at an elevation of 1,600 ft. Again, the form *aristonache* could not be regarded as a subspecies as it graded into typical *doris* in the localities where it was found, and similarly *transiens* graded into *eratonia*, and the forms were not geographically separated, although tending to become so.

MIMICRY (?) IN EREBIAS.—Dr. CHAPMAN exhibited some *Erebias*, on which he made the following observations:—

At Le Lautaret in Dauphiny last July I captured some *Erebias*, and Mr. H. J. Turner has handed me some taken by him at Karer See in Tyrol. These specimens have reminded me of a communication to this Society by Mr. Tutt on November 4, 1896, and one by myself to the E. M. M. of May 1901. These various observations seem worth bringing together, as they show that at Lautaret *Erebia melampus* and *E. ceto* assume forms very closely resembling *Erebia pharte* as it occurs there, and that at Guarda (Lower Engadine) and at Karer See the same species is closely copied by *Erebia manto*. *E. pharte* is involved in each instance, being closely approached at Le Lautaret by both *E. melampus* and *E. ceto* and in the two other localities by *E. manto*.

I have no facts to enable me to say that this is a case of mimicry of any sort, though it looks very like it, or whether it may be due to some influence climatic or other that produces a resemblance between all the species that may be



called " Grass " *Erebias* (a definition we owe, I think, to Mrs. Nicholl) when they occur at a high level.

The specimens exhibited are such that they will no doubt be recognised by Fellows who have done any collecting in Switzerland at over 5,000 ft. as very usual, and I believe there are sundry varietal names to which they are entitled. It is not the actual forms, but their association that claims attention.

When the resemblance between *melampus* and *pharte* at Le Lautaret attracted Mr. Tutt's attention in 1896, he thought that it signified that the two species were there connected by intermediate links that showed they were one species. On examining these species for my communication to the Society in 1898, I found nothing in Mr. Tutt's collection to substantiate this view, but merely that specimens of each species closely approached the other in appearance. I have not unfortunately any of Mr. Tutt's most illustrative specimens, and I did not pay enough attention to these species last summer to meet with such intermediate forms, but those I exhibit show a considerable approach between the two forms, and I must refer to Mr. Tutt's observations in proof that these do not show so much in this direction as they might.

It will be noticed, however, that the general appearance of the two species is very close, and that the two rows (one of each) that I exhibit have a very close general aspect, that differs considerably from the equally close general aspect of the two rows (of *pharte* and *manto*) from Guarda. I have placed between the two rows of *pharte*, a row of the species from Carinthia, much brighter and more richly marked than the species usually presents in Switzerland, but the ordinary *pharte* of Switzerland does differ from the special forms exhibited, somewhat in this direction. It is perhaps apposite to add that this form of *pharte* was accompanied by an equally bright form of *eriphyle* on the Koralp. This summer at Le Lautaret I also found specimens of *ceto* of a size and colouring that made them indistinguishable from *pharte* and *melampus* until caught; I exhibit five of these specimens in contrast with *ceto* from a lower level.

I may add that I think *epiphron* ought to be added to this group (as also to the Guarda set) as another member,

though I do not happen to have enough specimens to feel sure of this; it certainly flew with the others, and was not usually recognised until captured.

On turning to the Guarda group (really Val Tuoi, 6,000 ft. and upwards) the general coloration here has a distinctly sooty-black tone, such as culminates in the nearly black var. of *manto*, named *caecilia*, which contrasts with the redder brown-black of the Le Lautaret series. I have added several lower level *manto* for comparison. Mr. Turner's *manto* from Karer Pass are, again, of a more ruddy form.

The change from what I regard as a normal form in all these races, is in smaller size, darker colour and diminution of the rusty spots and bands. Assuming this to be for some reason an effect of high level, it will hardly account for the change having the same amount and direction in the several species at each locality, but not identical with the change at another station. There is obviously a tendency for each species, whilst undergoing this change, to approach its neighbours that are undergoing a similar alteration.

What I have said perhaps implies that *pharte* is constant and that the other species approach it, but the movement by *pharte* is really quite as great as by *manto*, *melampus* or *ceto*. *E. melampus* occurred at Guarda more or less with the *pharte* and *manto*, but preserved its own facies there, differing altogether from the *pharte-manto* combination, but varying to a form without any black spots in the rusty band. This band, however, remained quite bright and clear, wholly unlike its greater or less obsolescence in *pharte* and *manto*. I might perhaps add that these two species were fairly common and always together in about equal proportions.

It seems very desirable that considerable series of these species should be taken at localities where they occur together. I anticipate that such concomitant variation as my exhibit shows, would be found to be not uncommon.

Prof. POULTON observed that he saw no other solution so probable as that of mimicry, and that though the bird population was now small it may have been greatly reduced by man, birds on the Continent not enjoying the protection now extended to them in England.

Mr. H. ROWLAND-BROWN said that in Cantal the resemblance between *E. melampus* and *E. epiphron* was so close that they were difficult to separate.

Mr. H. J. TURNER remarked on the close resemblance at Mürren between the *Erebias manto*, *stygne*, *oeme* and *medusa*, and at Cortina between *E. pronoe* and *E. euryale*, var. *ocellaris*.

The Rev. G. WHEELER also spoke of the close resemblance at Mürren between *E. manto* and *E. oeme*, the nearly black forms *caecilia* of the former and *lugens* of the latter being predominant. He observed that this was the more remarkable in that these were generally high mountain forms, whilst at Mürren, and even above in the Blumenthal, *Lycaena arion* showed no tendency towards *obscura* nor *Chrysophanus hippothoe* towards *eurybia*. He could only state the facts, not account for them.

The PRESIDENT observed that in the Sefinenthal, near Mürren, but not in the direction of the Blumenthal, *L. arion* does tend to the *obscura* form.

Prof. POULTON suggested that perhaps in such associations as those of the *Erebias* exhibited, those specimens which did not conform to the general pattern might be more conspicuous, and consequently more apt to be weeded out.

PIERIDS AND THEIR SCENT-SCALES.—Dr. F. A. DIXEY exhibited a drawer containing specimens of the genus *Pieris*, with drawings of their scent-scales, and remarked on them as follows :—

Dr. A. G. Butler, writing in the Annals and Magazine of Natural History, 7th series, vol. ii, 1898, p. 17, divides the genus *Pieris*, Boisd., into four groups or sections, the first three of which are represented by *P. demophile*, Clerck, *P. viardi*, Boisd., and *P. phileta*, Fabr., respectively. With these three sections I do not propose to deal, further than to say that they are no doubt closely allied to each other, and to certain other American species such as *P. pyrrha*, Fabr., *P. malenka*, Hew., *P. lorena*, Hew., and *P. lypera*, Koll., which have sometimes, I think erroneously, been included in the genus *Mylothris*. The fourth of Dr. Butler's groups, which may be called the *P. buniae* section, stands well apart from the others. All the males, as Butler observes, exhibit well-

developed patches and streaks of thickened scaling on the wings. When a scraping from these streaks is examined microscopically, it is seen to consist almost entirely of peculiarly-shaped scent-scales, somewhat resembling those of the genera *Huphina* and *Delias*, and quite distinct from the scent-scales of the other three groups of *Pieris*. There are specific differences between these scent-scales which are often of service in the determination of specimens. I propose to offer a few remarks on some members of this *buniae* group, and especially on some captures lately made in Venezuela by Dr. G. B. Longstaff.

About *P. buniae*, Hübn., there is little doubt or difficulty. It is a large form from Brazil, white with a black apex and posterior margin, more or less indented internally, on the fore-wing; a dark spot, sometimes double, at the end of the cell on the under surface of the hind-wing; and a black discoidal spot, larger in the female, on both surfaces of the fore-wing. The hind-wing in the female usually bears dark marginal spots. The scent-scales are long, narrow and tapering, with rounded base and small accessory disc. They vary slightly in size and shape. Those from the hind-wing are shorter and broader than those from the fore-wing. The species is well represented in the Burchell Collection at Oxford, and both sexes are adequately figured in Seitz's "Macrolepidoptera."

*P. ausia* was described by Boisduval from specimens captured in the environs of Pernambuco, *i. e.* the coast region of the extreme east of the South American Continent. The male and female from the Hope Collection agree well with Boisduval's description. The extent of the apical dark area of the fore-wing is in both sexes less than in *P. buniae*, and the female has a dark curved band passing from the costa over the distal end of the discoidal cell. Seitz's account of *P. ausia* differs in some respects from the above and from Boisduval's description. He does not figure the species. The scent-scales closely resemble those of *P. buniae*, but are on an average slightly narrower.

*P. phaloe*, Godt., is widely distributed in the north-east of S. America, including the island of Trinidad. Its locality

is given by Godart simply as "Brazil." It is nearly allied to the two preceding species, but easily distinguishable from them by the parallel dark markings on the underside of the hind-wing, which are specially interesting as affording material for an incipient mimetic pattern. The posterior of the two bands is clearly homologous with the dark spots at the end of the cell in *P. buniae* and *P. ausia*. The scent-scales of *P. phaloe* are very much like those of *P. buniae* and *P. ausia* in size and shape, but can usually be distinguished by the attenuated distal portion, of which the sides are parallel instead of tapering. As in *P. ausia* the scent-scales tend to be somewhat narrower than in *P. buniae*.

The three preceding species are, I think, all very closely related. The next species to be mentioned, though certainly belonging to the same section of *Pieris*, stands a little apart from the first three. This is the form described by Felder from the Bogota district as *P. diana*. It is not unlike *P. buniae* in general appearance, but has the dark apex of the fore-wing generally narrower. It also differs in shape from that insect, the apex being more pointed, the hind border of the fore-wing being slightly concave, and the anal angle of the hind-wing somewhat prolonged. The scent-scales, though of the same elongated kite-like character as those of the three preceding species, are considerably shorter.

Closely allied to *P. diana* is *P. serata*, described by Felder from Venezuela. As to this form there is some degree of doubt. There is a specimen (♂) in the Collection of the British Museum which is presumably a co-type. It came through Messrs. Godman and Salvin from the Kaden Collection, and bears on a manuscript label "*serata*, Mz." (*i. e.* Moritz) and the locality note "Venez." (Venezuela). No female specimen is assigned to *P. serata* in the British Museum Collection, but there is another Kaden *Pieris* from the Godman-Salvin series which, though unplaced as such, must I think be a female *serata*. It corresponds well with the description of the female given by Felder. Under the subspecific heading *P. sincera*, Weym., are two males and a female from Venezuela which bear on pin labels "*P. serata*, Felder." These I am inclined to refer, not to *P. serata*, but to another species to be mentioned shortly.

On Jan. 11, 1913, Dr. G. B. Longstaff captured at a height of about 1,000 ft., between Curatici and Zigzag, Venezuela, five individuals, two males and three females, all of which belong to this section of the genus *Pieris*. I have no doubt that the two males are Felder's *P. sevata*. They answer perfectly to the description, and correspond closely with the Kaden ♂ in the British Museum. With regard to the females I do not feel so certain, but I think that at least one of them, that numbered by Dr. Longstaff 451, is the female of *P. sevata*. The female numbered 433 is more problematical. It corresponds well in size and shape with *P. sevata*, but is strikingly deficient in the dark markings of the upper surface. The scent-scales of Dr. Longstaff's two males, are like those of *P. diana*, being of about the same length, but slightly narrower.

On March 29, 1907, Dr. Longstaff took in the same locality as the preceding a male *Pieris*, which is well figured on Plate III, figs. 1, 2, of his book entitled "Butterfly Hunting in Many Lands." On page 320 of the same work he mentions the circumstances of its capture, and cites my opinion that it is "near *P. sevata*, Feld., and appears to be identical with three specimens from Venezuela placed in the National Collection under *P. sincera*, Weymer, but which might well be considered as a distinct species, or at any rate local race." These three specimens are those referred to above, p. cxii. I have no doubt whatever that Dr. Longstaff's specimen (numbered 1927) is quite distinct from *P. sevata* as represented by the two males captured on Jan. 11, 1913. It is smaller, differs somewhat in shape, and has a well-marked dark spot at the end of the cell on the underside of the hind-wing, the males referred to *P. sevata* being immaculate beneath. All these points are such as might characterise seasonal phases of the same species, but what really differentiates the present form from the authentic *P. sevata* is the distribution and character of the scent-scales. In *P. sevata* ♂, the mealy streaks formed by the scent-scales on the upper surface of the fore-wing fuse along the inner or posterior side of the median vein between the internal vein and the first median branch; in the present species there is no such fusion, and the clear area of the

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interno-median interspace reaches right up to the trunk of the median vein itself. This condition is accurately reproduced in Dr. Longstaff's figure. Besides this distinction, there is a well-marked difference in the scent-scales themselves. Those of *P. sevata* are, as already noticed, comparatively short. Those of the present form are more than half as long again as those of *P. sevata*, and considerably longer than those of *P. buniae*, *P. ausia* and *P. phaloe*. They are, moreover, of a different shape from those of the rest, the tapering from base to apex being much more gradual.

A female captured by Dr. Longstaff at the same time and place as the four *P. sevata* already mentioned (Jan. 11, 1913) must, I think, be referred to the present form and not to *P. sevata*. It corresponds with the male in size and shape, and has, like that sex, a well-marked dark spot at the end of the cell on the underside of the hind-wing, just anterior to the third median branch. The present form may be a subspecies of *P. sincera*, described by Weymer from a male specimen captured on the sea-level at Guayaquil, Ecuador. It differs, however, from Weymer's figure and description in some particulars.

Another species of this section of *Pieris*, at present undescribed, is represented in the Hope Collection by a male and two females from Lower California. This species is much smaller than the other members of the *buniae* section, and differs considerably from them in aspect, especially by the greyish-brown shading of the underside. Its scent-scales are very nearly the longest known to me. They are of like character with those of the last species (from Venezuela), but are appreciably longer.

The nearest relatives of this Lower Californian species appear to be *P. amaryllis*, Fabr., from Jamaica, and *P. josepha*, Godm. and Salv., from Central America. *P. josepha*, though a much larger insect, resembles it in general appearance and in the character of its scent-scales. The latter are actually the longest known to me in this genus, being more than half a millimetre in length, and easily visible to the naked eye. They are only exceeded in length, so far as I am aware, by those of two or three species of the genus *Huphina*.

There are other members of the present section of *Pieris*, but those that I have mentioned are the only ones that I have been able to submit to microscopic examination. *Pieris limona*, recently described by Schaus from Costa Rica (Proc. Zool. Soc. Lond., 1913, p. 356, Plate I.II, fig. 5) appears to be a Central American representative of *P. buniae* or *P. diana*.

THE METHOD BY WHICH FLEAS INFECT WITH PLAGUE.—Mr. A. BACOT exhibited slides showing the development of Plague bacilli in the alimentary canal of the Flea, and the method of infection through the mouth, and read the following paper :—

The conclusion that fleas are the responsible agents in the transmission of Bubonic Plague from animal to animal, first arrived at on epidemiological grounds by Ogata (1897), Simond (1898), Ashburton Thompson (1900), and Liston (1905), has received abundant proof at the hands of later workers, among whom may be named Gauthier and Raybaud (1902-3), Verbitzki (1904), and the Commission for the Investigation of Plague in India (1906-7). Simond's initiatory experiments in flea infection have been confirmed by an overwhelming weight of testimony.

It was found that the bacilli multiplied freely in the stomach of the flea, but the exact method of infection was left in some doubt. In the absence of any definite proof of transmission through the mouth, the general consensus of opinion tended to the view that plague bacilli, voided by the flea with its faeces, came in contact with punctures made by fleas, or found entrance through abrasions in the skin caused by the animal scratching itself.

Experiments undertaken by Dr. Martin and myself, with a view to testing the possibility of mouth infection, were performed with specimens of *Ceratophyllus fasciatus* and *Xenopsylla cheopis* under conditions that precluded the possibility of infection by the fleas' dejecta. The results satisfactorily establish the fact that mouth infection does occur, and suggest the conclusion that it is not only a possible, but perhaps the general, method by which the disease is spread.

It is not necessary for me to describe our experiments and methods in detail, as an account will shortly be available in



the Journal of Hygiene, but I wish to bring to your notice how the development of *Bacillus pestis* in the alimentary system of the flea causes it to convey infection through its mouth. The alimentary system of the flea includes a long sharp tubular pricker formed by the opposition of the mandibles and epipharynx, through this tube the blood is drawn, owing to the action of a powerful pump in the head of the flea. From the pump the blood passes along the oesophagus, a narrow but elastic tube, to the proventriculus or gizzard on its way to the stomach. The proventriculus when at rest is shaped very much like a tangerine orange; internally it is armed with a series of rings of slender curved chitinous spines; externally it has a series of hoops or belts of muscles. Normally this organ forms an efficient valve, owing to the constriction of the muscular bands narrowing and elongating the organ, and causing the spines to meet in the centre.

After a meal of infected blood, the ingested bacilli become the starting-points of colonies which increase in size until they cause the stomach contents to be of a lumpy nature, and finally the stomach may be completely filled with a solid mass of plague culture, which can be removed on dissection like jelly from a mould. At the same time the bacteria also multiply among the spines of the proventriculus, clogging its action and blocking the passage to the stomach. The pumping apparatus is, however, still efficient, and further feeding not only tends to distend the proventriculus, but the oesophagus as well, the blood in the latter being under pressure in an elastic tube. The bacteria develop in this fresh blood where it comes into contact with the obstructing mass of plague culture, and the possibility of the flea regurgitating a blood culture of *Bacillus pestis* into the next wound it makes is brought about.

In some instances continued efforts on the part of the flea enable it to get some blood past the stoppage, but in many instances the mass of bacteria develops forward into the oesophagus, forming a solid cone in front of the entrance to the proventriculus; in this case the flea's efforts are in vain. Meanwhile the jelly-like mass in the stomach gradually disintegrates and passes out of the flea, as the supply of nutriment for the bacteria becomes exhausted.

Fleas in this condition, unable to satisfy the cravings of an empty stomach, are most persistent in their efforts to obtain food, and lose much of their accustomed shyness. In two instances fleas in this blocked condition were fed on a shaved area on eight rats in succession, and in one instance on twelve. Two minutes was the time allowed on each rat, and in some instances so eager were the fleas that they would make a second attempt before they could be removed. In one experiment three out of nine rats on which two blocked specimens of *X. cheopis* had been fed in succession died of pest, and in a similar experiment with *C. fasciatus* the two fleas were responsible for the death of three rats out of nine.

This stoppage of the alimentary canal does not apparently necessitate the death of the flea if the block is only in the proventriculus. We have among our sections some which show the process of the clearance of an old block and the formation of a new one in its several stages. It seems questionable, however, if the flea can survive long enough without food for the plug to disintegrate if it forms a solid cone in the distended oesophagus, such as is exhibited in some of the specimens I have to show.

Blocked fleas have been observed by us to emit a minute droplet of blood from the base of the pricker while feeding, and from its tip at the moment of removal from the skin, and our sections show that blood remaining in the oesophagus and pharynx is heavily infected.

Dr. JORDAN, commenting on this very important paper, observed that it proved conclusively that infection was through the mouth of the flea, and not, as he had previously thought, through the faeces.

A CURIOUS LARVAL HABIT.—Dr. K. JORDAN exhibited some specimens of a lepidopterous larva which is most remarkable for its adaptation in habits and colour. The specimens were discovered by the Rev. A. Miles Moss, F.E.S., who is chaplain of the English Church at Pará and a most ardent observer of Lepidoptera, having bred and painted, both at Pará and in Peru, many hitherto unknown larvae of butterflies and moths, particularly *Papilionidae*, *Sphingidae* and *Saturniidae*. When collecting near Pará a Saturniid caterpillar with black

intersegmental bands and long branched spines, a species of *Automeris*, he noticed that some of the black bands appeared to be swollen. To his amazement these swellings, when touched, quickly slid over the back of the caterpillar to the other side with the hurried motion of a Pyralid larva, and indeed turned out to be small lepidopterous larvae as black and glossy as the bands of the *Automeris* caterpillar. Mr. Moss found it very difficult to catch these larvae with the forceps on account of the swiftness with which they rushed from one side of the host to the other. They are well protected by their colour as well as the long spines of the *Automeris*. It is to be hoped that Mr. Moss will succeed in obtaining more explicit information about this curious larva and in breeding the moth.

*Instructions for exhibiting specimens in the Epidiascope.*

The Rev. G. WHEELER explained to Fellows that the Epidiascope, by means of which the last two exhibits had been made, would not throw on to the screen anything of greater size than an ellipse of 11 ins. by 8 ins., and further, that, in consequence of the construction of the instrument, any specimens exhibited in a box of larger dimensions must be placed at the right-hand side of the box. It is also necessary to remember that the edges of a box throw a shadow, and that it is therefore important that specimens for exhibition should not be placed too close to the edge.

*Papers.*

The following papers were read : —

“ Revision of the Mexican and Central American *Malachiidae* and *Melyridae*, with descriptions of new species,” by GEORGE CHARLES CHAMPION, F.Z.S.

“ Four new genera and species of *Hymenoptera* from Australia,” and “ Three new species of Australian *Hymenoptera*,” by A. A. GIRAULT, communicated by A. M. LEA, F.E.S., Govt. Entomologist, South Australia.

Wednesday, December 3rd, 1913.

Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S., President, in the chair.

*Election of a Fellow.*

Mr. WALTER ORMISTON, of Kalupahani, Haldumille, Ceylon, was elected a Fellow of the Society.

*Presentation to the Library.*

Dr. G. B. LONGSTAFF presented to the Society, on behalf of a number of subscribers, a copy of Hübner's "Exotische Schmetterlinge," original edition, being the copy selected by the late Mr. W. F. Kirby for Mr. Roland Trimen; the names of all the subscribers will be placed in the first volume. Dr. Longstaff had collected £84 6s., and the Society had subscribed £10.

*Nomination of Auditors.*

The PRESIDENT announced that he had nominated the following Fellows as Auditors:—On the Council, Messrs. R. ADKIN, J. E. COLLIN and A. E. GIBBS; other Fellows, Messrs. H. ST. J. K. DONISTHORPE, R. W. LLOYD and C. O. WATERHOUSE.

*Exhibitions.*

ABERRATIONS OF ABRAXAS GROSSULARIATA.—Mr. G. T. PORRITT exhibited two curious specimens of *Abraxas grossulariata*. In the first the fore-wings were asymmetrical in marking, and the left lower wing was wanting, there being absolutely no trace of it. In the other the right lower wing was also wanting, but in its case there was a rudiment of it visible. He had bred both specimens this year, he believed from about a couple of hundred larvae from the same garden.

MINICRY AMONG SWALLOWTAILS AND OTHER NOTES ON BUTTERFLIES AT SÃO PAULO, BRAZIL.—Miss DIANA R. WILSON, who was present as a visitor, read the following communication:—

" These butterflies were caught in Brazil this year, during the last week of January and the first week of February, but as I was there on other business time was very limited for collecting. Also I am a novice in the art and am indebted to Prof. Poulton for the following facts.

" The larger swallowtail, which is the model, is *Papilio chamissonia* f. *chamissonia*, Eschsch., belonging to Section I of the great *Papilio* group, called 'Aristolochia Swallowtails,' Roths. and Jord., or 'Pharmacophagus Swallowtails,' Haase.

" The smaller one, mimicking the larger in almost every detail, is *Papilio* (*Cosmodesmus*) *lysithous*, f. *lysithous*, Hübn., and belongs to Section III, known as 'Kite Swallowtails,' Roths. and Jord., or 'Cosmodesmus Swallowtails,' Haase.

" The city of São Paulo lies about 2,500 ft. above the sea in a country of hill and forest. The immediate surroundings of the town are cleared, and large areas are partially mapped out for future building. It was on this at present waste and undeveloped land that I caught the swallowtails and other butterflies. The gardens and houses of the finished streets were on the upper side of a large open space sloping downwards into the country, and the trees were mostly in the gardens. One tree particularly, *Vochysia tucanorum*, M. and G., with its mass of golden blossom, was most attractive to butterflies, and it was in that neighbourhood that I did most of my catching. These particular swallowtails were by far the commonest things on the wing. They would hover high up round the yellow blossoms and then fly down and out into the more open ground. They seldom settled, but fluttered slowly and rather sleepily so that they were easy to catch. Unfortunately at the time I did not know I had a case of mimicry under my eyes or I should have taken more trouble to make exact observations.

" On January 31, I caught two specimens of *P. lysithous*, on February 2, three of *P. chamissonia*, and on February 4, two of each species. My impression is that the numbers flying were usually about equal. I should say the mimics were quicker and more alert flyers, but both kinds were easy to catch, and very common. They often annoyed me, too, by 'resurrecting.' I always pinched the thorax and then put

them into a killing-bottle, but when folding them into their papers afterwards I was often startled by sudden movements which made me hastily return them to their bottle. Nothing else seemed to die so hard. As I was not specially on the lookout for a difference in the vitality of the two species, I cannot be certain that there was no difference, but I am fairly sure that all the swallowtails required an extra dose of killing-bottle.

"The open ground was more or less bushy and in places covered with a wiry white-flowering plant—*Sida rhombifolia*, L., about a foot high. This harboured all sorts of smaller butterflies and the swallowtails were constantly fluttering among them. Except round the tree they hardly ever flew more than shoulder-high and did not often go far out into the open. In the heat of the day there would be dozens on or near their favourite yellow tree. They were always very conspicuous on the wing, but so alike that I often did not know whether I was catching model or mimic till I had them dead in my hand. Seeing them now, set side by side, there is a much bigger difference in size than I should have expected.

"There are a few other species to which I should like to draw attention, all but two caught on the same open waste.

"i. Two specimens of *Papilio polydamas polydamas*, L. (Section I), caught on January 31 and February 6. One specimen of their mimic, *Papilio scamander grayi*, Boisd. (Section II, viz. 'Fluted Swallowtails,' Roths. and Jord., or 'Papilio Swallowtails,' Haase), caught on February 7. Two specimens of another mimetic swallowtail, belonging to the same Section II, *Papilio anchisiades capys*, Hübn., the male on February 8, in the hotel garden, the female on February 4, on the waste. I only caught one specimen of each of the latter, but I saw more, chiefly frequenting the yellow tree, *Vochysia tucsanorum*. They usually flew high and were not nearly so numerous as *P. chamissonia* and *P. lysithous*.

"ii. One specimen only of the Brassoline butterfly. *Penetes panpharis*, Doubl. and Hew., which I caught on February 8, in the hotel garden. It was sitting on a tree-trunk with wings folded, and was very inconspicuous, the underside of the wings harmonising so well with the bark. I saw other specimens of this species sitting thus on trees, motionless for hours, but

always high out of reach of the net. I only saw them on the wing in the evening.

"iii. Three specimens of *Peridromia epinome*, Boisd., and two of *Ageronia ferentina*, Godt., all except one *Peridromia* (which was caught on February 4) taken on February 7. They made a peculiar clicking noise as they flew and were aggravatingly clever at dodging the net. They settled on grey tree-trunks, their wings spread flat, exactly like bits of lichen. They were particularly numerous in an old shady garden which I visited but did not collect in.

"iv. Two ♀ specimens of *Callidryas philea*, L., caught on February 2 and 7. They were fairly common on the waste, but they flew very fast and high and were extremely difficult to catch.

"There is one other small point of general interest. I noticed that as a rule, orange or bright-brown butterflies settled on orange flowers, yellow butterflies on yellow flowers (particularly the little *Terias deca*, Dbl., on *Pavonia sepium*, St. Hil.), and grey butterflies, or those with brownish undersides on tree-trunks.

"My thanks for this paper are due to Prof. Poulton for his interest and help, without which the collection would never have come into existence."

Prof. POULTON congratulated Miss Wilson on the interesting results which were the outcome of so small a collection made in so short time. He showed an example of the Pyralid moth *Myelobia smerintha*, Hübn. (*Gallerianae*), in Miss Wilson's collection, and said that the species, although very common, was well worth attention on account of its enormous size. It appeared to have great powers of flight, two specimens in the British Museum having been taken at sea over 100 miles from the S. American coast. He also said that, when informed by Dr. Kari Jordan that nothing had been published on the habits in life of these "Aristolochia Swallowtails" and their mimics, he realised that Miss Wilson's observations were of great interest and ought at once to be put on record.

MR. C. O. FARQUHARSON'S RECORD OF EROTYLID BEETLES FOUND IN CLAY CELLS.—Prof. POULTON exhibited eight examples of *Episcaphula interrupta*, Lac., found in one clay

cell, and eleven examples found in another, by Mr. C. O. Farquharson, B.Sc., at Moor Plantation, near Ibadan, S. Nigeria. The history of the discovery was given in the following extract from a letter written, Sept. 23, 1913, by Mr. C. O. Farquharson to Mr. Lamborn. The beetles had been kindly named by Mr. K. G. Blair, F.E.S.

"The two small clay cells which I brought you the other night were found (Sept. 19, 1913) on an old stump by the side of one of the streams in the plantation. On collecting the first one, the base was somewhat damaged and I was surprised to find the interior nicely filled with a collection of small beetles. The second cell I collected unbroken, and as I found the opening loosely blocked I thought perhaps it might contain a Hymenopteron of some sort. As you know it also contained small beetles, similar to the other."

[Prof. Poulton, in exhibiting the specimens, suggested that the beetles had been stored by an Aculeate; but a later letter from Mr. Lamborn, dated Dec. 3, 1913, stated that the beetles "had obviously congregated of their own accord, for both the clay cells were open and the beetles in one were so lively that Mr. Farquharson had to plug the hole to keep them in during the walk home."]

MR. W. A. LAMBORN'S OBSERVATIONS ON THE DRIVER ANTS (*DORYLUS*) OF SOUTHERN NIGERIA.—Prof. POULTON read the following notes received from Mr. Lamborn and exhibited the material referred to. The ants had been kindly determined by Mr. G. Meade-Waldo and the Diptera by Mr. E. E. Austen.

1. *Dorylus helvolus*, L. (*Typhlopone punctata*, Sm.).—A series of workers of various sizes. "These reddish ants appeared to be engaged, some in bolting earthworms from their burrows, others in killing the smaller ones, cutting them into sections, and carrying them off." Aug. 10, 1913: Agege, about 12 miles N. of Lagos.

2. *Dorylus nigricans*, Illig.—Two long series of workers of various sizes, one accompanied by the note: "These ants were marching in column at Agege after rain on August 20," the other captured, Oct. 12, at Moor Plantation, near Ibadan. The following notes refer to this species of *Dorylus*, and record observations made at Moor Plantation in 1913.



3. *The predaceous habits of D. nigricans*.—An extract from Mr. Lamborn's letter, dated Nov. 1, speaks of "disaster from a totally unconsidered source which swept away in a night 15 or 20 pupae of the *P. cardui* family, about 10 pupae from wild *cardui* larvae and 7 or 8 of the Satyrid pupae. I awoke one morning to find these all gone without leaving any traces. Ultimately I found two major and one minor driver ants in a test-tube of water left in one of the boxes; so the ants had raided my dining-room during the night and evacuated the position by morning while I was comfortably asleep, as usual, in my camp-bed out on the verandah. I don't think I mentioned that they came in one day last week at 7 a.m. and cleared the house of all other insects, including *Pheidole* and the small red ant *Monomorium pharaonis*, L., and they even caught two unfortunate bats in the eaves, one of which was killed, but I managed to free and let loose the second. On this occasion I repulsed the drivers with very heavy losses, but this does not seem to have been a lesson to them. Much to the disgust of my boy I always put most of my boxes on the table for the night so that, as the ants did not get up the rounded polished legs, my loss is not so bad as it might have been, and the *dardanus* family did not suffer."

4. *Camponotus sericeus attacking Dorylus nigricans on the march*.—The following note referred to the specimens exhibited to the meeting, viz. two workers of *Camponotus sericeus*, F., one of them with a worker minor of *Dorylus nigricans*, Illig., fixed to its leg.

"I send two ants, one with a 'driver,' soldier minor, gripping its 2nd right tibia. The history of the specimens is as follows:—On June 12, 1913, at 2 p.m., after heavy rain, a column of drivers was observed on the march along a channel between two earthworks which they had thrown up across the path. On the top of the earthwork were the two ants, evidently bent on mischief of some kind. They leaned over, narrowly examining the column of drivers and every now and again seized a minor which was released after a short scuffle. When a major came with open jaws to reinforce the minors, these ants did not retire but anteflexed the abdomen so that its point was presented between the fore-legs. The major then

retired precipitately, doubtless owing to the discharge of an offensive odour or noxious fluid. Occasionally the ants fell down from the earthwork on to the top of the drivers and then beat a most hurried retreat over their backs, though the drivers did not seem to attempt to attack them.

"These manoeuvres went on for a quarter of an hour, and I then dropped a slightly maimed minor driver near one of the two ants. The ant seized it at once and anteflexed its abdomen; a tremendous scuffle ensued, the combatants rolling over and over in a confused heap. The driver then seemed to gain the upper hand, for the other ant started to run away with its opponent firmly fixed on to its leg, and no efforts on the part of the ant were successful in dislodging it.

"I think the ants were on the look-out to steal pupae or prey from the drivers, but it is a matter I will look into."

Prof. Poulton suggested that the senses of the wounded *Dorylus* might have been blunted so that it was not susceptible to the defensive secretion of the *Camponotus*.

5. *The fly Bengalia depressa*, Walk. (*Calliphoridae*), robbing *Dorylus nigricans* on the march.—The following notes were illustrated by a specimen of *Bengalia depressa* and the second series of *Dorylus nigricans* referred to on p. cxxiii. Both were dated Oct. 12. The specimens illustrating the notes of later dates were not yet available.

"I spent most of this Sunday morning, Oct. 12, in watching a column of driver ants, many carrying immature forms, on the march, endeavouring to find out the business of the other ants [*Camponotus sericeus*] with them. I found that some Diptera, insects as large as a *Sarcophaga*, were also concerned with the drivers, but I did not succeed in elucidating their object any better than I did the purpose of the ants. About eight of these Diptera were to be seen settling here and there, usually on an elevated object, *e. g.* a stone close beside the drivers, which, in a column about two inches broad, were crossing the road. Every now and again one flew up and poised itself on the wing immediately over the column, whereupon the larger soldiers assumed a threatening attitude and the fly retired. Sometimes a fly ran over the ant column

with abdomen slightly anteflexed as if it might be ovipositing, but of course the difficulty of deciding if an ovum was dropped would be well-nigh insuperable.

" I succeeded in catching one fly only, for they were so very alert, and it was not easy to scoop them up from off the ground. I took the opportunity of securing some drivers for the Hope Collection and discovered a very easy way of getting them. By irritating them with a straw a number of the larger soldiers were induced to fasten on to it; then immediately other ants fastened on to them and in a few seconds hundreds of the ants, massed into a ball, were hanging to the straw. It was surprising though how soon the minors got to the centre of the mass and the majors concentrated on the outside.

" I then amused myself by carrying balls of ants to varying distances and in seeing how the ants managed to get into communication with the main column and how long it took them."

The following note is dated Nov. 1 :—" I believe these large Diptera which I see constantly waiting on ' Drivers ' on the march must manage to oviposit on the immature forms. It seems so wonderful that the flies should have any business at all with these ants that are so formidable as to make even *Homo sapiens* give way before them at times."

The problem was finally solved in a letter dated Nov. 8, and received only last Monday, Dec. 1 : --" I succeeded to-day in solving the problem as to the relationship between the *Muscidae* mentioned in my letter of Oct. 12, and the black driver ants. A column of drivers was crossing a conduit over a stream, following precisely the same ant-path that I have seen them traverse several times before, and I was able to sit down on the parapet comfortably in the shade and watch them. I soon saw three or four of the *Muscids* flying about the moving column and occasionally settling near it, sometimes on the ground quite close to the ants, sometimes on a blade of grass, stone or other raised object. Such as settled on the ground were extremely alert, and being able to run rapidly, never allowed any ants to approach any nearer to them than about a quarter of an inch. When, as frequently happened, any ant made a little circuit away from the main body, a fly would

generally pursue it at a distance of about half an inch, but backing away directly the ant turned towards it.

"Other flies, having rested motionless a few minutes, flew up and poised themselves on the wing over the ants, but, immediately the drivers realised their presence and stretched out towards them with widely opened mandibles, flew again to a place of rest. Eventually I saw a Muscid stalking a minor ant which had strayed from the main body carrying a pupa in its jaws. Suddenly the fly rushed forward, and it must have driven its proboscis, which seems to me armed with strong bristles, into the pupa, for the ant was brought to a standstill with a sharp jerk.

"Then ensued a tug-of-war between ant and fly fastened on at opposite ends of the pupa, but neither had the advantage till, as it seemed to me, the ant must have got annoyed and loosening its hold rushed towards the fly, which of course instantly flew off with the pupa, and this it proceeded to suck on the ground about a foot away from the ants. It allowed me to get quite close before taking to the wing with its prey, and it settled again two or three feet further off and became so preoccupied with its meal that it fell an easy victim to my net.

"I then carefully watched a fly hovering over the ant-column. It suddenly swooped down and rose instantly with an ant pupa, with the driver that had been carrying it still hanging on, fixed to its proboscis. The fly carried this burden for about a foot then dropped it and alighted on the ground near by. The ant started to run away with the pupa, but the fly pursued it, again impaled the pupa and started a tug-of-war with the ant. Neither side had any advantage, and then the fly rose again about three feet into the air with the pupa and ant and after a flight of about eighteen inches let them fall. The ant being discomposed by this procedure let go of the pupa, and no sooner had it done so than the fly seized it and, flying off with it triumphantly, settled near by and proceeded as in the previous case to suck the prey. This one again fell easily to my net, so that the flies are evidently keenly alert only when in the immediate vicinity of the ants. I subsequently noticed that the Diptera seemed to have certain

preferences in regard to their prey, for I repeatedly noticed one poised over the ant-column make an unsuccessful swoop and then fly, keeping level with the ant carrying the particular object which it had missed, making occasional rushes in an endeavour to secure it. Those I took had obtained ant-pupae, but I am sure they take other things from the drivers, probably portions of dead insects, but I shall look into the question further.

"The flies were not always successful even when they had separated an ant with its burden from the main army, for a large ant carrying a small burden often got away owing to the difficulty the fly experienced in getting hold of the load without falling into the jaws of the ant.

"I subsequently witnessed these manœuvres many times and, as you will see, secured a little series, each fly with its particular prey and the ant concerned."

Prof. Poulton said that Dr. G. D. H. Carpenter, to whom he had communicated the substance of Mr. Lamborn's observations, had stated that, according to his experience, the Driver ants, when on the march, carried pupae and never larvae, and that, when hunting, they did not even carry pupae. Dr. Carpenter's observations were made upon *Dorylus nigricans* in Damba and Bugalla Islands, in the N.W. of the Victoria Nyanza.

Mr. E. E. Austen had called his attention to a note by Dr. Gaillard on *Bengalia gaillardi*, Surcouf, preying on Termites in a rotten tree-stump which had just been dug up at Konlouba, French Sudan, Aug. 13, 1908; recorded by Surcouf in Bull. Mus. Nat. D'Hist. Nat., 1912, No. 7 (published Apr. 1913), p. 427.

Prof. Poulton also referred to Mr. E. E. Green's and Capt. K. E. Nangle's notes on the attacks of an allied species, *Ochromyia obscurepennis*, Bigot, and *jejuna*, F., on winged Termites in Ceylon and Secunderabad, to Col. J. W. Yerbury's observation in Ceylon that *Ochromyia* steals sugar grains from large ants (Trans. Ent. Soc., 1906, pp. 394-6), and to Mr. E. E. Green's confirmatory observations in Ceylon, together with his description of the strongly toothed tongue of the fly (Proc. Ent. Soc., 1908, pp. xxvi-xxvii). The Ceylon species

was not *Ochromyia jejuna*, as stated in the publications referred to above, but *O. obscurepennis*, Bigot. The following note by Col. Yerbury accompanied the series of this species in the British Museum :—" Very common in shady places. I have more than once seen this fly trying to take her burden from a large ant (*Lobopelta* sp.)—regular 'pulley-hauley' game." Col. Yerbury believed that the hold of the fly's tongue was given by suction and not by piercing—a conclusion probably supported by Mr. Lamborn's observation that the fly could drop the pupae at any time. It was clear, however, that the tongue was used as a piercing organ when the fly was feeding on the Termites and ant-pupae. The following note by Col. F. W. Thomson, I.M.S. (Dehra Dun, U.P., India, Nov. 1907), was borne by a specimen of the Indian species *Ochromyia jejuna* in the British Museum :—

"I always noticed specimens of this species on the ground, or on a stone or leaf near an ant's nest. On watching, I saw them swoop down on any ant carrying an 'egg' or larva, take it from the ant, carry it away a short distance, and proceed to suck it."

Col. Thomson's record pointed to habits similar to those here described by Mr. W. A. Lamborn. It was to be noted also that the Ponerine ant *Lobopelta*, robbed by *Ochromyia*, was allied to the Driver ants and itself hunted in companies somewhat after the manner of a driver.

Mr. E. E. GREEN observed that *Dorylus orientalis* was a garden pest, eating potatoes, dahlia roots, etc. Unlike the African forms it was largely or wholly a vegetable feeder. Col. YERBURY said that in Ceylon *Ochromyia* was predaceous, and took sugar and other things away from *Camponotus* ants. Mr. E. E. GREEN also remarked on the structure and habits of *Ochromyia*.

SOUTH AMERICAN PAPILIOS.—Dr. K. JORDAN exhibited a series of species of the two groups of Papilios called by Haase *Cosmodesmus* and *Pharmacophagus* respectively, and said :—The American mimetic forms of *Cosmodesmus*, which contrast so strongly with their more normally coloured relatives, are undoubtedly modifications derived from a more generalised type, such as is represented by *Papilio asius*.

This species connects the American mimetic species of *Cosmodesmus* with the non-mimetic ones, and would be an interesting object for the study of the wing in the pupa inasmuch as the imaginal wing in the pupa might show traces of the cell-bars which are so common in *Cosmodesmus*, but entirely lost in the imago of *P. asius*.

All the mimetic American *Cosmodesmus* resemble "Aristolochia Papilios" of the same country, with the exception of *P. pausanias*, which imitates a *Heliconius*. In the Oriental Region, where "Aristolochia Papilios" also abound, the mimetic *Cosmodesmus* on the contrary all bear the garb of *Danainae*. Such mimetic resemblances are often ascribed to the common ancestral pattern being preserved both in the model and the mimic. This explanation may be true in some instances, but it does not apply to the mimetic *Cosmodesmus* as a whole, as the Eastern Danaine pattern and the very different colouring of the American species cannot both be ancestral in *Cosmodesmus*.

Like many other mimetic Lepidoptera, the American mimetic *Cosmodesmus* present some interesting cases of polymorphism. We consider the tailed *Cosmodesmus* of South-Eastern Brazil allied to *P. lysithous* as forms of one single species (*lysithous*, *aedipus*, *rurik*, *pomponius*, etc.), and also believe that *Papilio protodamas* is the same species as *choridamas*. These conclusions are mainly based on a study of the structure. But morphological evidence, though it may afford guidance, cannot be accepted as sufficient. The final court of appeal in such questions is breeding, and we hope that some day some entomologist resident in South-Eastern Brazil will give up mere collecting in order to devote himself to the elucidation of the life-histories and habits of the Lepidoptera.

THE ASSOCIATION OF THORICTUS AND MYRMECOCYSTUS.—Mr. CHAMPION exhibited a specimen of *Thorictus pauciseta*, Wasm., attached to the scape of the left antenna of a worker of an ant, *Myrmecocystus viaticus*, F., found by Dr. Santschi and himself at Kairouan, Tunisia, last May. The beetle possesses a tuft of golden hairs at each hind angle of the prothorax, the secretion from which is said by Wasmann to be appreciated by the ants. Numerous examples of the beetle

were found in the nests, and occasionally one of them was found attached by the mandibles to the antennae of the ants, the ants themselves being extremely active.

Mr. DONISTHORPE observed that *Thorictus* was always associated with ants, and carried about by them in this manner.

THREE INCIPIENT COLONIES OF ANTS BROUGHT UP BY UNAIDED ♀♀.—Mr. W. C. CRAWLEY exhibited :

1. Three dealated ♀♀ of *L. niger*, L., taken Isle of Wight, July 1911. These, after rearing ♂♂s, fought until only one survived. During 1912 the ♂♂ reached the number of 200, and the ♀ had long ceased to function as a ♀. All the ♂♂ died in March 1913 owing to drought, but the ♀ revived her colony founding instincts, and had brought up two new ♂♂ by the beginning of Sept. 1913. She has taken no food since Feb. 1913, though her supply of body-fat and degenerating wing-muscles must have been exhausted during the founding of her first colony in 1911 and 1912.

2. A ♀ of *Aphaenogaster subterranea*, Latr., taken Aug. 1912 at Yvorne with Prof. Forel, after marriage-flight, brought up two ♂♂ by Sept. 1913. Has taken no food.

3. Six ♀♀ of *L. flavus*, Fabr., taken after marriage-flight at Seaton, July 14, 1912. They built a cell together and brought up ♂♂ by June 23, 1913. The ♂♂ now number 50-60, and there has been no hostility among the ♀♀. No food was taken till Aug. 14, 1913.

A large-eyed variety of *Lasius umbratus*, Nyl., taken at Wellington College in 1910. The ♂ considerably smaller, darker, and less yellow than either *L. umbratus* or *mixtus*; the head longer and narrower, the antennae less clubbed, and the eyes twice as large.

STALK-EYED FLIES.—Mr. O. E. JANSON exhibited specimens of *Laglasia caloptera*, Bigot, one of the curious forms of Diptera with stalked eyes, from the Arfak Mountains, Dutch New Guinea.

GONEPTERYX CLEOPATRA.—Capt. E. B. PUREFOY exhibited two more specimens of *Gonepteryx cleopatra* with gynandromorphous colouring, being ♀♀ in general appearance but with patches of ♂ colouring. He observed that the larvae were



now feeding and were doing so at the end of November in Kent.

**NORTH AMERICAN BUTTERFLIES.**—Mr. E. B. ASHBY exhibited a number of Nearctic Butterflies, including several belonging to genera widely distributed in the Palaearctic Region.

**HELICONIUS ANDERIDA.**—Mr. W. J. KAYE exhibited a very large series of specimens of *Heliconius anderida* ranging into a number of forms which tended to become fairly definite subspecies in different geographical regions. In Panama in the canal zone the following named forms occurred and were so intergraded that they could only be looked on as aberrations of one variable species; such were, *clara*, Fab., *melicerta*, Bates, *albucilla*, Bates, *albipunctata*, Riff., *zuleika*, Hew. In Costa Rica the *zuleika* form occurred almost exclusively, and only very rarely did forms occur that were referable to *albipunctata*, Riff., but specimens transitional to this latter form were less rare. In N.W. Venezuela, near Porto Cabello, a further development occurred out of the *anderida* and *clara* forms, in which a submarginal row of paired yellow spots appeared on the hind-wing, the fore-wing being normal *clara*. This form had apparently no name and it was proposed to call it *estebana*.\* A further set of specimens was from Colombia from the so-called Bogota district, but which really referred to a much lower elevation. These specimens were the usual *clara* form and were more or less constant. A single specimen from the Rio Dagua in W. Colombia was shown of the *holcophora* form. It was thus shown that in Panama the species was altogether unstable, but both northwards, eastwards and still further eastwards definite races were developed. The series was

\* **HELICONIUS ANDERIDA ESTEBANA**, n. sub-sp.

♂. Fore-wing like *H. anderida clara*, but with less yellow within the cell and the large black blotch extended towards the base as a wedge. The black spot on the yellow patch between veins 2, 3 large and nearly touching the edge of the cell. Hind-wing with broad black marginal band containing four pairs of elongate yellow spots. ♀. Fore-wing as in ♂, but with a great extension of black beneath vein 2. Hind-wing with the black marginal band becoming broken at vein 4, and with the innermost pair of yellow spots barely visible. A single elongate yellow mark above vein 7.

*Habitat.* San Esteban Valley, N.W. Venezuela.

divided geographically into sections from Costa Rica, Panama, N.W. Venezuela and Colombia.

SCENT APPARATUS OF AMAURIS EGIALEA.—Dr. H. ELTRINGHAM gave a preliminary account of the scent apparatus in *Amauris egialea* comparing the same with that of *A. niavius*, illustrated by drawings, and microphotographs of sections of the brush. He remarked on the complicated structure of the brush, showing the existence of black and brown hairs together with three other kinds of structures, of irregular section and presumably varied function.

*Paper.*

The following paper was read :—

“ New Species of South American Butterflies,” by W. F. H. ROSENBERG, F.E.S., and G. TALBOT, F.E.S.

Mr. TALBOT made the following exhibits in connection with this paper :—

1. Sixteen new species of S. American Butterflies.
2. A black and brown mimetic combination from Yahuar-mayo, S.E. Peru, October and November, 9 species, viz :—  
*Athyrtis salvini*, Stgr., *Napeogenes seminigra*, sp. nov.,  
*N. deucalion*, Hnsch., *Ceratinia callanga*, Hnsch., *Melinaea orestes*, Salv., *M. clara*, sp. nov., *Hirsutis melanina*, Hnsch.,  
*Heliconius sisypheus*, Salv., *Eresia*, sp. ?

NOTE.—See p. lxxvi.

ON A NEW GENUS OF MYMARIDAE.

By FRED ENOCK, F.L.S., F.E.S., F.R.M.S.

NEUROTES, n. gen.

The tarsi 5-jointed. The abdomen sub-sessile. The antennae of the male 13-jointed, those of the female 8-jointed. The wings broad and elliptical .75 mm. long  $\times$  .208 mm. broad. The costal nerve very long. The ovipositor level with the tip of the abdomen.

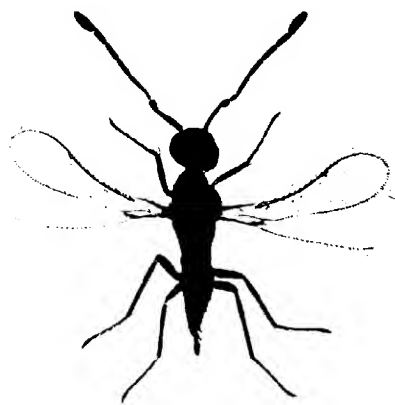
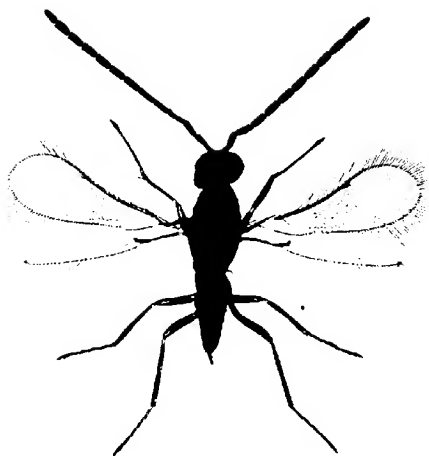
NEUROTES IRIDESCENS, n. sp. (Plate A, figs 1 and 2.)

The general colour dark brown; the head broader than the thorax. The antennae of the male 13-jointed, dark brown, 1 mm. in length, the scape twice as long as the funicular joint, the third to the twelfth joints of equal length; the thirteenth a little short.

The antennae of the female 8-jointed .57 mm. long. The scape and pedicel testaceous, the latter a little longer than the first funicular joint, the others gradually diminishing in length to the club, which is the longest joint and rounded at the tip. The ovipositor level with the tip of the abdomen. The wings narrower and shorter than those of the male. The costal nerve very long, reaching to beyond the middle of the wing, the tip slightly enlarged. The cilia long. The surface hairs most numerous at the base and margins of the wing, leaving an almost clear oval area in the centre. The cilia long on the lower wings. The legs lighter brown than the body, and darkest in the centre.

Length 1 mm.

*Hab.* Hollington Wood, Hastings. August 1913. Male and female captured.



*Photo E. Enock.*

*E. Enock.*

*Neurotes iridescens*, Enock, x 40.



. ANNUAL MEETING.

Wednesday, January 21st, 1914.

Mr. G. T. BETHUNE-BAKER, F.Z.S., F.L.S., President, in the Chair.

No other names having been received in addition to those proposed by the Council as Officers and Council for the ensuing year, the following were declared by the President to be elected :—

*President*, Mr. G. T. BETHUNE-BAKER, F.L.S., F.Z.S.; *Treasurer*, Mr. A. H. JONES; *Secretaries*, Commander J. J. WALKER, M.A., R.N., F.L.S., and Rev. G. WHEELER, M.A., F.Z.S.; *Librarian*, Mr. G. C. CHAMPION, A.L.S., F.Z.S.; *Other Members of the Council*, Messrs. E. A. BUTLER, B.A., B.Sc., J. E. COLLIN, F.Z.S., S. EDWARDS, F.L.S., F.Z.S., Dr. H. ELTRINGHAM, M.A., D.Sc., F.L.S., C. J. GAHAN, M.A., A. E. GIBBS, F.L.S., F.Z.S., E. E. GREEN, G. MEADE-WALDO, M.A., Dr. G. W. NICHOLSON, M.A., M.D., Hon. N. C. ROTHSCHILD, M.A., F.L.S., F.Z.S., H. ROWLAND-BROWN, M.A., C. J. WAINWRIGHT.

Mr. R. W. LLOYD, one of the Auditors, read the Auditors' Report, which was adopted on the motion of Mr. H. E. PAGE, seconded by Mr. J. PLATT BARRETT.

The Rev. G. WHEELER, one of the Secretaries, then read the following

Report of the Council.

Since our last Annual Meeting we have lost one Honorary Fellow, the Poet-Scientist, Prof. O. M. REUTER. To the vacancy thus created Mr. A. P. SEMENOFF TIAN-SHANSKI has been elected.

Amongst the nine ordinary Fellows whom we have lost by death during the year are both the oldest and the eldest Fellows of the Society, viz. Lord AVEBURY and Dr. ALFRED RUSSEL WALLACE, both former Presidents, who enjoyed those distinctions respectively; the other seven being Messrs. LIONEL ARMSTRONG, HERBERT DRUCE, at one time a member

of the Council, Lieut. C. A. FOSTER, PHILIP DE LA GARDE, THIEN CHENG KUNG, A. G. LETHBRIDGE and G. MEYER-PACINI. We have also received notice of the death of Mr. P. W. MACKINNON, which took place in 1911. Only three Fellows have been removed from the list, but the number of resignations is unusually large, being twelve; some of these, however, are only intended to be temporary. Our total losses from all causes thus amount to twenty-six, whilst thirty-nine ordinary Fellows have been elected, bringing our total up to 618, composed of 12 honorary and 606 ordinary Fellows.

The most important event we have to chronicle is that His MOST GRACIOUS MAJESTY, KING GEORGE, has consented to become our Patron. As this gratifying fact does not carry with it the title of Royal, the Council, after causing inquiries to be made, informally consulted the Society as to whether steps should be taken to make any alteration in our title; the response, however, was not such as to justify them in calling a Special Meeting to consider the question.

The Society was represented at the International Congress of Zoology at Monaco by Lord WALSINGHAM, the Hon. WALTER ROTHSCHILD and Dr. KARL JORDAN. At this Congress the vexed subject of Nomenclature was much discussed, and a beginning made towards an adequate recognition of the claims of Entomology in this matter, by the inclusion of as many Entomologists as the regulations with regard to retirement would permit, in the International Zoological Committee of Nomenclature.

Following on the Resolution placed by our Society before the International Congress of Entomology, held at Oxford in 1912, an International Entomological Committee of Nomenclature has been formed, on which one of our Fellows, Mr. C. J. GAHAN, sits as the British Representative. At the same time the National Committees have been set on foot, and our Society has elected as its representatives on the English Committee Messrs. J. H. DURRANT, L. B. PROUT and C. O. WATERHOUSE. It has also appointed a permanent Committee of its own, consisting of the British member of the International Committee, its three representatives on the National Com-

mittee, the Secretary of the Society and two elected members, who at the present time are the PRESIDENT and Dr. K. JORDAN.

The Royal Horticultural Society having asked for the names of Entomologists competent and willing to act as members of their Parliamentary Committee, the names of Prof. THEOBALD, Mr. MAXWELL-LEFROY, Prof. NEWSTEAD and Mr. GUY MARSHALL were submitted to them; they took, for the moment, the first-named of these gentlemen, but hope eventually to include them all.

A very cordial invitation having been received by the Council to be represented at the Jubilee of the Entomological Society of Ontario, our Honorary Fellow, Prof. COMSTOCK, was deputed to act as our representative.

Two important matters bearing more or less directly on our Science have been before us this year—Nature Reserves and the upkeep of Wicken Fen. Towards the latter object an annual subscription of two guineas has been voted by the Council.

Our Transactions for this year form a Volume of 693 pages, containing 30 papers by the following Authors :—The PRESIDENT, (2), Messrs. H. BOILEAU, F.E.S., A. E. CAMERON, M.B., B.Sc., F.E.S., MALCOLM CAMERON, M.B., R.N., F.E.S., (2), G. D. H. CARPENTER, B.A., B.Sc., F.E.S., (3), G. C. CHAMPION, A.L.S., F.Z.S., F.E.S., (2), J. E. COLLIN, F.Z.S., F.E.S., F. W. EDWARDS, B.A., F.E.S., H. ELTRINGHAM, M.A., D.Sc., F.L.S., F.E.S., (3), J. C. F. FRYER, M.A., F.E.S., (2), W. J. KAYE, F.E.S., (2), Sir G. H. KENRICK, F.E.S., W. A. LAMBORN, M.R.C.S., L.R.C.P., F.E.S., G. B. LONGSTAFF, M.A., M.D., F.E.S., E. MEYRICK, B.A., F.R.S., F.E.S., Rev. F. D. MORICE, M.A., F.E.S., J. C. MOULTON, F.L.S., F.E.S., R. C. L. PERKINS, M.A., D.Sc., F.E.S., (2), W. F. H. ROSENBERG, F.E.S., jointly with G. TALBOT, F.E.S., and F. H. TAYLOR, F.E.S. Of these 16 refer to Lepidoptera, 5 to Coleoptera, 4 to Diptera, 3 to Hymenoptera, and 2 are of general Entomological interest.

These papers are illustrated by 44 plates, consisting of 6 chromo-lithographs, 2 three-colour plates, 3 black lithographs, 23 half-tone plates and 10 line blocks. Of these Mr. F. D. GODMAN gives the entire cost of two chromos (Plates III and IV), Dr. G. B. LONGSTAFF the entire cost of one chromo



(Plate II) and the accompanying map; Mr. J. C. MOULTON gives the drawing for one chromo (Plate X) and also contributes half the cost of reproduction, and Mr. W. J. KAYE gives the drawings for the other two chromos (Plates I and XXX). Dr. H. ELTRINGHAM gives the drawings for the three black lithographs (Plates XX, XXII and XXVII); Sir GEORGE KENRICK contributes the entire cost of the two three-colour plates (Plates XXXI and XXXII), and the Rev. F. D. MORICE the entire cost of three of the half-tones (Plates XXXIII, XXXIV, XXXV). The drawings and photographs for all the other plates have been supplied by the Authors, and Prof. POULTON also contributes towards the reproduction of Plates XXXIV-XL, illustrating Dr. Carpenter's Papers.

The Proceedings amount to 134 pages, and contain one half-tone plate illustrating the new *Mymar* exhibited by Mr. F. ENOCK, who supplied the photograph for the plate.

The TREASURER reports as follows :—

Although the total receipts in 1913 were about £34 less than in 1912, the balance sheet is of a far more satisfactory character. Several factors are instrumental in bringing about this result: *Firstly*: The Grant from the Royal Society which belonged to 1912 was paid in the beginning of 1913. *Secondly*: The cost for Plates has been small, £69 8s. 4d. against £254 1s. 6d. in 1912. *Thirdly*: The cost for Printing is £368 9s. 11d. against £409 13s. 1d. in 1912.

The surplus arising from these differences has enabled us, after paying all bills rendered, to invest all life compositions, amounting to £110 5s., in Consols (including the £47 5s. uninvested in 1912), and to carry forward a balance to 1914 of £134 5s. 10d., nearly sufficient to meet the cost of Parts III, IV, and V.

The LIBRARIAN reports that forty-nine volumes, the usual periodicals and publications of Societies, and a large number of separate have been added to the Library during the past year, a list of which will be included in Part V of the Transactions. Notably among the donations to the Library may be mentioned *Fauna Hawaïensis* (3 vols.), which was presented by Dr. SHARP; the continuation of Wytzman, *Genera Insectorum*, given by Mr. E. A. ELLIOT; *Études de Lépidoptérologie Com-*

*parée*, by Charles Oberthür, presented by the Author, and Hübner's *Sammlung Exotischer Schmetterlinge* (3 vols.), which was subscribed for by Fellows of the Society and others. Five hundred and ten volumes have been issued for home use, as against a total of four hundred and seventy-eight volumes the previous year. As usual, the Library has been well used for the purpose of reference.

The Report was adopted on the motion of Mr. R. S. STANDEN, seconded by Mr. R. W. LLOYD.

The PRESIDENT then delivered an Address, after which Prof. POULTON moved a Vote of Thanks to him, coupled with the request that he would allow the Address to be printed as a part of the Society's Proceedings; this was seconded by Mr. W. J. LUCAS and carried by acclamation.

The PRESIDENT returned thanks and Mr. O. E. JANSON then proposed a Vote of Thanks to the other Officers for their services during the past year; this was seconded by Mr. T. F. P. HOAR and carried, the TREASURER and the two SECRETARIES returning thanks in a few words.



( cxxxix )

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Adopted on the motion of Mr. R. S. STANDEN,

THOMAS LLOYD.

read an Address, after which Prof. Hübner addressed the Society, and then Mr. Lloyd, who was coupled with the motion, proposed that the Address should be printed as a part of the Proceedings, and was seconded by Mr. W. J.

NOTICE TO FELLOWS. E. JANSON

Please substitute the enclosed pages cxxxix and cxl for their respective places in the 1913 volume in place of those issued. Mr. J. J. J.



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( cxl )

# ENTOMOLOGICAL SOCIETY OF LONDON.

## Balance Sheet for the Year 1913.

RECEIPTS.			PAYMENTS.		
	£	s. d.		£	s. d.
Balance in hand, 1st Jan.,			Printing Transactions, etc.	368	9 11
1913 ... ..	16	18 9	Plates, etc. ... ..	68	8 4
Subscriptions for 1913 ...	490	7 0	Rent and Office Expenses ... ..	159	3 6
Arrears ... ..	21	0 0	Investment in Consols as	61	7 4
Admission Fees ... ..	42	0 0	per contra, including the		
Donations (including £60			£47 5s. carried over from		
received from the Royal			1912 ... ..	110	5 0
Society) ... ..	80	10 5	Subscriptions in Advance		
Sales of Transactions ...	153	15 1	as per contra carried to		
Interest on Investments—			1914 ... ..	18	18 0
Consols ... £28 13 4					
Birmingham 3					
per cents. ... ..	6	15 4			
		35 8 8			
Subscriptions in Advance		18 18 0	Balance in hand ... ..	787	12 1
4 Life Compositions ...		63 0 0		134	5 10
		<u>£921 17 11</u>			<u>£921 17 11</u>

ASSETS.			LIABILITIES		
	£	s. d.			
Subscriptions in arrear			Cost of printing Parts 3, 4 and 5.		
considered good ... ..	30	0 0			
Cost of £1,292 1s. 2d.					
Consols. Present value					
at the price of 71½ on					
31st December, 1913,					
2927 1s. ... ..	1,185	18 0			
Cost of £230 12s. 4d.					
Birmingham 3 per cents.					
Present value at the					
price of 77 on 31st					
December, 1913, £184					
10s. 1d. ... ..	250	0 0			
Balance in hand ... ..	131	5 10			
		<u>£1,600 3 10</u>			
Additional Assets:					
Contents of Library, including					
Recent acquisition of Hubner					
"Sammlung Exotischer Schmet-					
terli ge" and unsold stock					
Less total depreciation of £324 6s. 11d. in the value of Securities.					

A. HUGH JONES, *Treasurer*,  
5th January, 1914.

R. W. LLOYD.  
HORACE DONISTHORPE.  
A. E. GIBBS.  
CHAS. O. WATERHOUSE.  
R. ADKIN.

## THE PRESIDENT'S ADDRESS.

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GENTLEMEN,

HIS MAJESTY THE KING has been pleased to confer on the Society his Royal Patronage during the present year, whilst in other ways also it has been one of continued prosperity.

If the Transactions do not reach to the large number of pages that they have occasionally done, they certainly have neither lacked in the interest of their matter nor yet in the variety of subjects treated on. Our meetings have been as largely attended as ever, whilst the number of exhibits has been so great that our hours of closing have been frequently rather late. All I think betokens continued prosperity.

The obituary record this year contains I regret to say the names of several eminent men. One honorary Fellow representing the Russian Empire has passed away—Odo Morannell Reuter of Helsingfors—Professor, poet and scientist, we can ill afford to lose him.

Lord Avebury, our oldest Fellow has gone from our ranks, and in him the world loses a large-hearted philanthropist and politician as well as a man of science.

Then Herbert Druce has gone also, in whom many of us lose a personal friend ever ready to help with his long experience and large collections.

Alfred Russell Wallace, the gifted co-discoverer with Darwin of the theory of evolution by Natural Selection, has joined his friend in the great beyond. A man whose magnanimity and modesty are evidenced in the fact that he christened their joint discoveries with the name of Darwinism, and spoke with rare felicity in exaltation of his friend's greater part therein at the Darwin-Wallace celebration on July 1st, 1908.

Five others have likewise passed to the great majority—Thomas Boyd, Philip de la Garde, Thien Cheng Kung, Lionel Armstrong and A. G. Lethbridge. It would be well if the courage and indomitable patience of a Reuter and the large-hearted highmindedness of an Avebury and the modesty of a Wallace could inspire each one of us to attempt greater things.

I will now pass to the subject of my address.



THE SCALES OF THE RURALIDAE, WITH SOME OBSERVATIONS  
ON THEIR COLOUR PROBLEMS.

It is manifestly impossible to deal adequately with so wide a matter in the course of a single address, but it has occupied my attention intermittently for many years and I thought it might be well to lay before you some of my observations, inasmuch as the scales of this group are very varied, many are very beautiful, whilst some have a peculiar interest of their own.

It is no doubt well known to all that the different areas of the wings have scales of different patterns, for instance the costa of the fore-wing, which needs to be strengthened as the cutting edge during the process of flight, generally has long scales different from the others; these are formed into a sort of cable, so to speak; the subcostal area differs in its scales from those covering the cell and these differ from those in the postmedian area, whilst the fringe scales (most beautiful objects under the microscope) are totally diverse in shape from all the others. In addition to these there are the various sexual brands of very varied structure and design, whilst there are also the extraordinary protective scales covering the entire surface of that peculiarly specialised insect *Liphyra brassolis*.

Before describing the scales themselves it might be well to explain one term that I have used; in the details of the "blasenschuppen" I have used the word "reticulations;" a reticulated surface in its strict sense should show a network, formed by lines crossing each other at different angles, and under a low power these peculiar scales have a reticulated appearance: to be accurate however they are crossed longitudinally only by rows of minute dots, and the fact that the rows are exceedingly close to one another gives them the appearance mentioned, I have therefore used the words "rows of reticulations" or "reticulated rows" as it expresses the general appearance, though technically it is not correct.

I ought also to add that in my preparations of butterflies with these structural colours all the Ruralidae have a second under layer of brown scales whose office might well be to absorb all the unused rays of light, and thus perfect the production of the colours of this group.

*Plebeius argus*, L. (*aegon* Auct.).

The costa is composed of a gradually tapering cable of long flattish scales that slowly taper distally and terminate generally in a sharply bifid extremity, though there are many with a trifid extremity among them, these scales are arranged in a heavy continuous bundle near the base, becoming gradually narrower and fewer up to the apex, the scales are without doubt a modification of those that form the fringe on the termen with which they eventually merge at the apex, they are at the base brownish but soon become white on the outer edge of the costa; between this and the costal vein the area is filled with blue scales not half the length of those just mentioned; they appear to be flat, but of course are not so, and are broad, tapering very slightly to the extremity, their bases are indented, a short fine stalk issuing from the indentation, whilst their apices have three equidistant incisions giving them a quadrifoliate (if I may use the term) termination, with these, nearer the termen, we find a few of another bluish scale like the costal ones but shorter and wider (though much longer than the ordinary scale just described) with a deeply and sharply quadrifid apex. The veins are all clothed with a combination of two or three different scales, and are always I believe brown, this being the case with the great majority of species examined. One other pattern is like that mentioned, but not so long and broader, another is similar but broader still and with four or five deepish serrations at the apex, whilst the third is a short very broad scale with a bluntly quinque-dentate apex. Between the costal vein and the cell, as also in the subcostal area above vein 7, the same pattern scales prevail as are found in the costal area, but those in the cell itself are different, they are much broader with no serrated extremities (though the basal attachment remains practically the same in all) but instead a quinque-foliate apex in many, though the majority of the scales in this area, for there are two sorts, have an even, very slightly undulated apex: the pattern on the fold is a still further modification, for whilst retaining the same size and shape as the scales in the cell, they have mostly assumed a perfectly even, slightly convex apex, though a certain number with an inclination to a slight foliation appear among them; in the

radial area below vein 7, including the upper and lower sections, the same pattern prevails as on the fold, whilst below vein 1 in the basal portion the scales are similar to those in the cell, but as they near the tornus they become like those on the radial area. The inner margin itself is fringed with fine, very long, bluish hair-like scales, quite cylindrical, that become whiter as they merge into the fringes proper, these scales are also found in some numbers over all the basal area. What we usually call the fringes, *i.e.* those scales which are found on the termen are always very beautiful objects, they are of two patterns both having the same shape and structure but with different lengths and apices, the shorter fringe scales are brown with very deeply and sharply quadriserrate apices with a few triserrate amongst them, both sorts are of an inverted lanceolate shape, on a fine, very long stalk, spreading out rapidly for the terminal third in a fan-like structure with very deeply serrated apices, the long terminal fringe scales are white, and have five and six exceedingly deep fine serrations at the apices—both these scales are very finely ribbed, so finely indeed that under a moderately high power we do not obtain a really adequate idea of the structure, the subterminal area is composed of brown scales similar to those clothing the veins, but the longest pattern with the quadrifid apex very largely predominates. All the wing scales are finely ribbed. We now come to the last type of scale that is found on the fore wing, one whose office is not yet known; usually it is devoid of colour, though not always, and it has attracted more attention than any of the others. I refer of course to the battledore scales, though personally I think the German appellation is much more to the point, *viz.* Blasenschuppen “bladder scales.” These are present under each row of ordinary scales in considerable numbers, they are in this species subovate with a long fine stem and have eleven rows of reticulations; they may be recognised at a glance nearly always on account of being devoid of colour (with a few exceptions) and always strongly shagreened, they are more or less rotund and are I believe, as has been stated by previous authors, only found in the male sex; it is however incorrect to state that they are only

found in blue species, I have found them in entirely brown species and they are present in all the wings upper and lower. In the secondaries the costa and also the inner margin are fringed with whitish long hair-like scales quite similar to those on the inner margin of the primaries, the costal and subcostal areas are clothed with brown scales similar to those on the veins of the primaries but with an admixture of an oblong scale having an evenly rounded apex, between the costal vein and the cell the space is occupied by an upper layer of short very broad scales of even width, except at the base which is rapidly rounded off, they have the same method and pattern of attachment as in the primaries but the apices are quinque- and sexa-dentate with a very irregular dentature, among these will be found some of the same pattern but a quarter longer, the lower layer are longish scales of moderately even width or very slightly tapering with quadri- and quinque-dentate apices, among them however a few with an even apex having no dentature at all obtain. In the cell some of the brown scales just described are present, but the blue ones begin to predominate and are different, being of a bell-like shape, of moderate length, very broad, slowly tapering to the apex which is uneven but not dentate; the rest of the wing is clothed with similar scales some of which have a quite even apex, and with an admixture of the brown scales also. At the inner margin the longish brown scales again predominate as also in the terminal area, the fringes are quite similar to those in the primaries but with modified apices being only bi- or tri-serrate, with only a few quadriserrate; the serrations are however of the same deeply cleft and fine pattern as in the fore wings, the "blasenschuppen" are less abundant in the secondaries than in the primaries but of the same shape and structure.

In *Plebeius sieversii* from the Caspian region the abundant blue scales in the subcostal area are of moderate length and width, tapering slightly distally, the apex being deeply dentate; in the other areas they are roughly spatulate, but the apices are mixed, either scalloped or quite evenly arched, and occasionally waved, these all appear to be mixed indiscriminately. The thick hair-like scale is finely ribbed and very

prominent in this species and is distinctly blue in colour, it is very long, tapering, slightly wider at the centre, whence it tapers down slightly to the apex which terminates in a blunt point—it is the widest scale of this type that I am acquainted with and is very plentiful all over the basal half of the wing, getting less so towards the termen. The “blasenschuppen” are large, almost oblong in shape, with a comparatively short attachment peduncle; they have usually ten rows of reticulations but go up to twelve.

In *Polyommatus icarus* the costal cable of fringe-like scales is not nearly so heavy and prominent as in *argus* (Linné) and at the basal area is largely mixed with the long hairs found in that area though these become brown on the costa whilst they are whitish elsewhere, the other scales differ in very minute particulars, showing the near relationship of the two species; they are however simpler in pattern and have more or less evenly terminated apices; the “blasenschuppen” exhibit a marked divergence, for in this species they are elliptical in shape tapering at the base slowly into the stem-like attachment, and have but six rows of dotted reticulations instead of eleven. In addition to the basal hair-like scales is another somewhat similar one, but much thicker, it is better developed in *thetis* and will be described under that species.

*Polyommatus semiargus* has scales throughout entirely of the *icarus* type, differing only in size more than actual shape, the thick hair-like pattern being very close to that species. The “blasenschuppen” follow closely the *icarus* pattern, being a long oval, slightly wider than in that species, and with seven rows of reticulations, though in one scale I counted eight.

In *Polyommatus thetis* the scales show some advance in development, in the basal area some of the blue ones have scalloped, whilst a few have waved apices, but the large majority of the blue scales are approaching the simpler pattern found so largely, as I shall show hereafter, in the brilliantly blue exotic species; this I am inclined to regard as a later development than the highly serrated scales of the brown and non-metallic blue species, in this case they have not the absolutely evenly arched apices but a very close approximation to that character, the distal end, though

sometimes evenly rounded, is more frequently slightly uneven. The special scale I would draw attention to however is a tubular hair-like one that is blue in colour, it is very long, though the length is not uniform, with the base quite as wide as the apex; the base is colourless, apparently quite empty, for the proximal eighth the tube tapers down more narrowly, and in the second narrow eighth the first vestiges of colour appear, it then assumes its usual width and terminates in a very bluntly rounded apex, it is really a hair-like scale though coloured, being perhaps three times the width of the very fine and longer basal hair-like pattern obtaining almost throughout the group. The "blasenschuppen" are ovate, broader than in *icarus* with seven rows of reticulations usually, though I have counted as few as six and as many as ten.

*P. eros* shows a yet further advance in the simplification of the blue scales—omitting those composing the costal cable, which in all cases is composed of special ones more or less similar, it being obviously necessary for the costa of the primaries to be particularly strong; they are of slightly varying sizes and widths in the different areas but are all more or less of the same pattern, being of moderate length, narrower at the base and tapering somewhat broadly up to the apex which is evenly terminated in a slight arch. The thick hair-like scales as described in *thetis* are present in some numbers, whilst the "blasenschuppen" are very numerous and of the typical *icarus* pattern; they are a long narrow oval shape with a long attachment peduncle and have four or five rows of reticulations; they are colourless, the reticulations appearing greyish, but under a condensed direct light they are brownish; they are then however so very obscure that an inexperienced eye would probably fail to see them.

*Plebeius anteros* possesses "blasenschuppen" of unusual size and interest whilst the ordinary blue scales are quite simple and for the size of the insect large; they are oblong, longish, rather broad, tapering very slightly indeed up to near the apex, from whence they reduce equally slightly to the apex which is very weakly curved, without any wave or serration; they are finely ribbed. The "blasenschuppen"

are about half as large as the ordinary blue pattern, rather more if anything; they are goblet-shaped, with a longish strong attachment peduncle tapering into the scale exactly as in a goblet; in sculpture they are ribbed, not reticulated as is usual with these scales, and are blue in colour; there can however be no doubt as to their being "blasenschuppen" from their shape, their stem, and the position they occupy.

*Polyommatus galathea* would appear from its general scaling to be very closely allied to *icarus*, but the "blasenschuppen" are more nearly related to the *Lycaena (arion)* group, the scales in each part of the wing are very similar to *icarus*; the thick hair-like scales are also present in fair numbers. The "blasenschuppen" are however different, they are largish and balloon-shaped, with eleven rows of large reticulations.

In *Lycaena arion* whilst the cable of costal scales remains similar, this being no doubt necessary for the strengthening and protection of the wing, there is a considerable admixture of bluish scales, on its internal side, of quite a different shape, that are long for a wing scale, in contradistinction to a marginal fringe scale, slightly tapering, of but moderate width, and with a deeply serrated apex having four sharp points; the neural scales are of medium length, generally brown, narrowish of almost even width, with serrated apices consisting of either a single or double serration, the costal and subcostal inter-nural scales are mostly brownish, of medium length and width, tapering slightly, wider distally, with the apex sharply triserrate, i. e. with four points; mixed with these however are a number of more or less blue scales similar to those obtaining on the internal edge of the costal cable. The cell and other blue areas are covered with two patterns of scales, brown ones and blue, both have minor deviations, both are broad, of moderate length, nearly even in width, in the case of the blue scales the apices are trifid or quadrid, not having the sharply serrate pattern but rather scalloped, the apices of the brown scales being evenly dentated with two or three dentations; the brown scales in the marginal area are similar to those on the veins, whilst at the base are to be found a large number of broad bell-shaped scales with irregularly dentated or scalloped apices, the terminal fringes are shorter

in pattern than in the case of the two species I have already described, and have more modified serrations, which are less deep and not more than four in number. The "blasenschuppen" are heavier in build than those described, being subovate with the apex rather flattened, they have eleven rows of broad deep reticulations, the attachment peduncle is of only moderate length. In the secondaries the base of the wing has a large number of brown bell-shaped scales with the excised attachment cleft very narrow and nearly perpendicular, the stalk itself being short and stout; the apex is dentated but the dentations are irregular both in number and pattern, these extend along the veins and slightly over the cell and the fold, as also into the costal area to about the end of the cell, whereabouts they appear to cease. The costal cable is composed of scales of three sizes and patterns, the largest being quite twice the length of the shortest, it is long and very broad, slightly curved, with the apex scalloped, the second is straighter, similar to the previous one but a third less in width, whilst the third is about half the length of the first, very broad, slightly tapering to the apex which is sometimes evenly hollowed and sometimes trifid, the subcostal areas are clothed with scales similar to these two latter. In the cell and on the fold the brown scales are present in some numbers and are superimposed over the blue, the latter being broad, moderately even in width, with quadridentate apices, though this last point is by no means universal, though general; the brown ones, in addition to a few of the bell-shaped pattern, are smaller than the blue, of moderate width, shortish, with the apex generally quadridentate but of irregular dentation. Those in the radial and postmedian areas are also of two patterns, viz. a subhyaline and a brown scale, both seem to be of the same shape and pattern, smaller than the blue scale in the cell; they are of moderate width and length, not tapering, with irregularly dentate apices, the "blasenschuppen" are well distributed over the whole wing even almost up to the termen.

In *Scolitantides baton* the ordinary blue scales are almost the same throughout all the areas of the wing, approaching somewhat nearly the brown species of the Plebeid group.



I therefore regard this as an early type; they (the scales) are longish, of moderate width, tapering rather wider to the apex which is scalloped more or less deeply. There is a large admixture of brown scales of quite different pattern throughout the wing. The "blasenschuppen" are very difficult to estimate, some are almost spherical, some are ovate with broadly rounded ends, others are very similar to the *arion* group; they have seventeen rows of fine reticulations.

Aurivillius has already pointed out that *S. orion* has no "blasenschuppen," and my own observations confirm this.

In *iolas* the blue scales are somewhat specialised, in the subcostal area they are longish, of varying widths, many having scalloped apices but in very varying degrees, and some have almost even or very slightly arched apices; it will be remembered that *iolas*, without being lustrous at all, is yet a very blue species, and the great majority of the blue scales are short and very broad, almost as broad as long, evenly terminated in a decided arch and very finely ribbed; they differ however in length in different parts of the wing; near the base they are longer and occasionally one will be seen distinctly scalloped, in the terminal area they are narrower and evenly oblong, the species has also the thick hair-like scales found so plentifully in the genus *Polyommatus*; they are of even length and terminated in a blunt point. The "blasenschuppen" are somewhat pyriform with eleven and twelve rows of coarse reticulations. In the subcostal area are several scales quite like the "blasenschuppen" in structure and sculpture, but about three times the size, and might be described as narrowly fan-shaped (an enlarged pyriform would be approximately fan-shaped), they take the place of the "blasenschuppen" and are mixed with them. I found them in each of the specimens examined, but in some there are only one or two whilst in others there are more of them; they are however of interest in that they show that mutation in this special form of scale is in operation.

*Melanops* is a species rather strongly blue to the naked eye; there is however a very large admixture of ordinary brown scales in both wings which are superposed on the blue ones; these latter approach closely to the patterns obtaining

in the last insect, those in the subcostal area being practically similar whilst the majority in the other areas are close also, being very simple and broadly spatulate rather than oblong. The thick hair-like scales are present in some numbers and do not differ from the usual structure and form, whilst the "blasenschuppen" are decidedly of the *Lycaena* type but are more spherical than those of *arion* (*arion* however has the longest of the genus); they have nine rows of distinct reticulations and occasionally ten, this may however be occasioned by the position of the scale.

In both the above cases the ordinary blue scales are very different from the *Lycaena* type.

In *Celastrina argiolus* the costal cable of the primaries is quite fine, as might be expected with a weakly flighted species, and is made up of the costal fringe scales; the subcostal and presubterminal areas are clothed with two kinds, a broad almost even (in width) long scale, that is irregularly dentated at its apex, and has a rounded base with a minute incision for the attachment stalk; with this pattern are mixed a few of a much longer shape, almost fan-like, *i. e.* narrow at the base and widening considerably to the apex, which is tricrenate, the central excision being less deep than the outer ones; the scales occupying the cell and the fold are decidedly shorter in length, tapering slightly from the rounded base to the apex which is irregularly dentate or crenate, the postmedian scales are of a similar pattern to those in the subcostal area, whilst those on the margin are narrower in width, the long fringe scales are very narrow proximally and for at least half their length, when they rapidly expand, and then, immediately in front of the serrated tip, slightly decrease in width; the apex is deeply quineserrate, the three middle serrations being the longest, but not uniform, sometimes one point being the longest and sometimes another point. The "blasenschuppen" are extraordinarily numerous and large, they are cup-shaped, deeply reticulated, with fifteen rows on one side. In the secondaries the basal brownish scales are somewhat squarely formed, having a subtriangular base whose apex is the incised attachment stalk; they are very broad and short and of even width, the apices being slightly rounded,

generally crenate, but sometimes quite even; with them are to be found a few blue scales of two patterns, the smaller one very similar to the brown one but rather longer and rounded at the base, the other is twice the length, slightly narrower, even in width with a tricrenate apex; the costa consists of entirely brown scales, those near the base are similar to the basal brown ones but rapidly change to a pattern having a somewhat cone-shaped even apex, these again give place to an uneven or lopsided scale, the outer half of which is more or less evenly pear-shaped, whilst the inner half has the base slightly excised as also the apex, but this latter is excised below the apex so as to form a squarish shoulder laterally, these continue up to the postmedian area where they are replaced by a longer narrower scale of even width with dentate apices; the costa itself has an edging of a single line of very smooth longish scales, slightly wider in the middle, but evenly terminated both fore and aft, and with them are mixed not only the hair-like fringe but also a scale that may be a modification of the fan-like fringe, viz. a long, narrow, even tube, bluntly terminated but very irregular in width, being very narrow with an almost pointed extremity; in the subcostal area the basal and the postmedian patterns are mixed together, and with them there is a large admixture of the blue cell scales which predominate as that area is approached; these blue cell scales are oblong with truncate apices that are decidedly crenate, all the blue scales being of this pattern, those on the abdominal fold are long, broad, of even width, very slightly reduced at the evenly truncate apex; the terminal wing scales call for no special remark.

In *Everes argiades* again certain differences are noticeable; the costal cable is composed entirely of long, thickish, hair-like scales (thickish in comparison with the somewhat colourless hair-like scales that are found in the basal and antemedian areas of most *Plebeinae*); they are brown, and mixed with them are a certain number of simple fringe scales, these becoming predominant towards the apex. The blue scales throughout the wing are of three patterns, a very broad shortish one that tapers slightly from the base and has a very irregular serrated apex; this is the predominant one and

obtains up to the postmedian area, where a longer narrower pattern begins to obtain with similar irregular apices; an occasional very blue and somewhat different scale is also present, having a very smooth surface, similar in shape, but tapering out more widely to the apex which is crenate not serrate. In direct light on a dark background these are all very blue, whilst the ordinary scale has a paler and a mauve tint. I have been quite unable to trace any difference in structure between these and the ordinary predominant pattern, the ribbing is similar yet it looks smoother and is decidedly different in colour. The brown neural scales are of two patterns, a somewhat bell-shaped one expanding rather rapidly and with an irregular much serrated apex, and a narrower and longer one also serrated but less irregularly; this latter is less abundant. The "blasenschuppen" are very numerous and are not unlike those obtaining in *Celastrina argiolus*, but not quite so large, and the apex is not truncate; it is therefore nearly globular but a little too long to be quite so, they have as a rule fourteen rows of reticulations on one side, but in certain cases I have counted fifteen, though fourteen appears to be the normal number. In the secondaries the scales above the costal vein are brownish, of unusual width and of moderate length, tapering to the apex which is rounded off unevenly, the outer apex being generally the longer and descending irregularly to the inner edge, the base of these scales is deeply cleft at the attachment stalk and very deeply and heavily lobed on the costal side, this lobing which obtains in certain species in this particular area is very interesting and is evidently an accommodation to the shape of the wing, I am not aware of its occurring where the scales have an entirely free course; the basal brown scales are short, broad, of even width, with a regularly rounded base with but little incision for the stalk, and with an unevenly dentate apex, the blue median and postmedian scales being a modification of this pattern, as might be expected in this case where they freely intermingle; they are rather longer, tapering slightly towards the tri-scalloped apex, the central division of which is the widest; those on the abdominal fold are long and narrower, even in width with a truncate apex, these are brownish at the

base, becoming blue when free from the overlap. The "blasenschuppen" are very numerous in the secondary as in the primary. It is interesting to record that the Indian *Everes parrhasius* has no "blasenschuppen" at all, thus proving conclusively to my mind the distinctness of the species.

*Tarucus theophrastus* is Plebeiid in its scaling; dealing with the blue ones only, the subcostal ones are longish, for so small an insect I should say long, tapering somewhat more widely to the apex which is scalloped; in the cell and median area they are broad, of moderate length, with the apex well arched and scalloped to a more or less degree; the same pattern obtains on the fold also. The "blasenschuppen" are very large and flask-shaped (i.e. the shape of a pocket flask) somewhat tapered at the base to meet the attachment peduncle; they have fourteen to sixteen rows of reticulations and extend practically to the termen of the wing, this being a very unusual character. They are Plebeiid in sculpture rather than of the *Polyommatus icarus* type.

*Lampides boeticus* presents some very remarkable features, more especially in its plumules, if I may depart from my adopted appellation "blasenschuppen" in this special species, the fact being that in this insect these scales are not bladder-like, though generally speaking they are so. In *boeticus* however we find these scales with a certain amount of colour, they are brownish, occasionally with a slight lustre, and very long, in shape like an Indian club, and they are extraordinarily abundant, being so plentiful as to completely cover the ordinary scales in some parts of the wing. I will however refer to them after the ordinary scaling has been described. The basal area above the cell is clothed with beautifully waved, fine, very long, greyish-white hair scales, under which are a layer of similar brown ones, the former extending also into both the cell and the fold; these cover entirely the ordinary wing scales among which are a few brown ones with very long and sharply dentated apices, the indentations between the teeth being very deep; the ordinary wing scaling calls for no very special remark but probably all lepidopterists will remember the somewhat rough and occasionally almost greasy look that *boeticus* has; this arises

I believe from the admixture with the "blasenschuppen" of (so far as I am yet aware) a unique scale, imitating almost exactly the plumule but inserted into the wing membrane at the other end of the scale and being entirely beautifully pale blue; these are the apparently hair-like blue scales all over most of the wing that give it the well known rough texture, they are, however, not hair scales but of the shape of an Indian club, with the club part longer in its tapering than in the plumule, and the thin end also longer and thinner than is the case with the other scale, the result being that this blue scale is a much longer and more elegant one than is the plumule, its apex is also more elegantly shaped, being rapidly tapered down to a rather blunt point; again, it is evenly ribbed, the ribs being practically parallel and disappearing as they approach the narrower part, whereas the "blasenschuppen" are irregularly striated from a central line. I was much perplexed in my early examinations of this insect at finding a large number of blue plumules, as I at first thought, mixed up with the brown ones, the former all with their club apices towards the termen, whilst the latter had their club apices towards the base of the wings, and frequently deeply embedded among the ordinary wing scales; it was some time before I realised that I had before me a pseudo-plumule in the blue one; such however is without doubt the case. The plumule itself is a much coarser and rougher object; generally, though not always, decidedly shorter than its mimic, with its narrow apical end less narrow than the blue one, the tapering being much more rapid, and the broad end broader, the attachment stalk being a short one emitted from the broad base which is more triangular than the apex of the pseudo-plumule; the striations of the plumule proper differ in number, they are striations, not reticulations, as is generally the case; I have counted from 15 to 18 or 19; they are deep and irregular and branch from each other, finally converging to a common termination at the apex. The essential difference in the two scales is that the broad club is the base and attachment end in the plumule whereas the club end in the mimic is the apex, the attachment to the membrane being at the thin basal end. Both the scales obtain in both the wings though the

pseudo-plumule is less abundant in the secondaries than in the primaries.

It has been said that *Lampides aratus* has "plumules" of a similar shape to *boeticus*; this however is an error, the plumules of all the species of the genus *Lampides* (i. e. of the *aelianus* group) that I have examined having short "blasenschuppen" of the *Celastrina* type, in fact I am at present unaware of any "blasenschuppen" similar to *boeticus* with one exception and that in a genus not nearly related to it; the species in question is *Uranothauma falckensteini*, the scale being an almost exact replica of the one found in *boeticus* only probably less than half its size; it is the same shape, has similar striations, with the attachment peduncle at the thick end, but the scale is finer in texture as also are the striations. The most interesting feature of these "blasenschuppen" however is that they are not distributed generally over the greater part of the wing as is usually the case, but are restricted to certain defined interneural lines and are of a purplish-blackish colour; mixed with them is another mimic "blasenschuppe" of the common "battledore" shape with four parallel ribs; these are numerous and do not occur apart from the long ones just described. These are perhaps with the large sex patch obtaining in the other species of this genus the simplest form of sex mark in the *Lycaeninae*, with the exception of the *Strymonidae*; it is also worthy of note that the ordinary wing scales are among the simplest of the group being plain oblong scales evenly terminated, the same scale being distributed over nearly five-sixths of the wing, those on the fold and in the costal area being only a narrower and longer modification of this pattern. The usual deeply serrated or scalloped apices are almost, though not absolutely, absent in this species.

*Polyommatus menalcas* presents several peculiar and interesting features, this being a species in which the median area of the primaries is largely covered with soft hair-like scales, and it was with considerable interest that I examined it. The base and costal cable are amply covered with the long, fine, hair-like, bluish-white scales common to most of the genera *Plebeius* and *Polyommatus*, but the soft brown hair-

like scales of the median area are quite different in several respects. They are many times as thick, very long, and waved, attached to the wing not by a short peduncle or stalk, but by a slight spreading of the base directly on to the membrane, the basal part of the scale is colourless, slightly swollen, soon becoming shortly constricted, at which part the brown pigment develops and the very fine ribbing begins; beyond this it very rapidly thickens slightly and remains of even width until near the apex, when it shortly tapers to a blunt point. With these scales, especially on the veins is found another from which it may be possible the former were evolved; it is unusually long and narrow, but not hair-like, it very gradually tapers wider to about a fifth from the apex, when it rapidly reduces to the tip which is abruptly and almost squarely terminated; the attachment stalk is also specialised, being between the ordinary method and that obtaining in the hair-like brown scales; it is thicker, and gradually tapers for a short distance to its juncture with the scale, whose base is simple, not ribbed, but again tapering up shortly to its juncture with the part where the usual ribbing arises, and from whence the rest of the scale is finely ribbed; these two joints (if I may use the term) are the nearest approach to hair structure that I have yet found, and the interesting part is that they do not occur in the hair-scales, but in a scale proper. The question that naturally arose was, will there be a modification of the usual wing scales that obtain under the brown hair-like scales? At the extreme base where the ordinary whitish hair scales still persist there was no modification, the scales presenting nothing worthy of note and having sharply serrated apices, but in the median area this was not so, the blue scales being of the simplest pattern; they are of a long oval shape, the apices being of two patterns, one quite evenly rounded, the other with a slight shoulder on each side, the apical edge itself however being quite evenly rounded off; these latter are very few in number. In the postmedian area the blue scales are much shorter but with similarly modified apices, so that one is led to wonder whether the brown hair-like scales were not at one time more largely spread over the wing. The "blasen-



schuppen," which are very numerous, are ovate, not always regular in size or shape, sometimes being evenly ovate, sometimes tapering slightly towards the apex; the attachment stalk is long, tapering, slightly wider at its juncture with the scale, which is coarsely ribbed, several that I have examined having nine ribs, others however had fewer. The scales of the secondaries show no such modifications as do the primaries. From this unusual example I went for confirmation to *Polyommatus dolus* var.  *vittata*, a species that has somewhat similar hair-like scales over the same area, only they are less copious and not quite so noticeable; in this case I found the long fine basal hair scales (bluish-white) more extensive, whilst the brownish ones (so prominent in *menalcas*) are perhaps less abundant but still very plentiful; they are similar in structure to those just described but rather finer; an extraordinary character however obtains in the ordinary blue wing scales, the whole of which are curled round so as to form more or less short tubes, the process appears to be that each side of the scales turns over, and occasionally they meet thus in the centre, but more generally one side will overlap the other and so form a more or less perfect tube, by this I mean of course that the basal and apical ends remain open—a tube that is sealed at each end naturally ceases to be a tube, becoming a cylinder. This peculiar and interesting development obtains with nearly all the upper layer of blue scales with the exception of those in the terminal area, the lower layer in this case are not brown but are more or less transparent brownish-grey, and they (not being as numerous as is generally the case) retain their normal shape and position. The "blasenschuppen" are plentiful, a long oval in shape, much the shape of a narrow specimen of the egg of the red-necked Grebe, with a longish attachment stalk as in *menalcas*, and having 7 or 8 rows of coarse reticulations, though in one large scale I counted 9, but the former seem to be the normal numbers. In the secondaries also the normal bluish scales are developed in exactly the same way into the more or less semitubular ones as in the primaries. Is it possible that we have here the early evolution of the long hair-like scales peculiar to this section of the genus *Polyommatus*?

*P. admetus* is more abundantly covered with these peculiar long soft scales than any other European species. What shall we find in this species? The scale is of the same structure and form as in the two last-mentioned only it is more robust, whilst those underlying, and in fact all over the wing in the median and post-median areas, are simply developed, with evenly rounded terminations. Again however we find an interesting character. It has been said, and I do not find that it has been pointed out to the contrary as yet, that no brown *Lycaenidae* have "blasenschuppen"; *admetus* however has them fairly plentifully in both wings; they are similar in shape to its congeners, but smaller, and with finer reticulations. I found in one specimen two quite abnormal examples of this scale, one being more than double the usual size and a second very much larger.

*Polyommatus meleager* is another species that is densely covered with long hair-like scales, as in those we have been just considering; the basal ones are of the usual type only very long and very fine, but they are succeeded by some of another pattern that cover the greater part of the wing surface, only the terminal area and a small part of the post-median subcostal area being free from them. They are ribbed exceedingly finely, in colour they are whitish, blue, bluish-grey and brown; in size they are very long and narrow, being twice to three times the width of the usual basal hair-like scales, and in length would exceed ten to fourteen of the ordinary wing scales in their usual overlap; in parts they are thickly packed together so that it is not easy to see the underlying scales, in which, as would be expected, we find some modification; they are finely ribbed, simple in pattern but very large in size—apart from those on the veins which are very broadly tulip-shaped with waved apices—being unusually broad; in shape they are very broadly ovate, the corners being rounded off rather too much to be able to call them oblong; they are slightly narrower at the base than the apex which is evenly arched somewhat; along the inner margin the pattern is elongated with a crinkled apex: the terminal scales are broadly tulip-shaped with slightly scalloped apices.

The "blasenschuppen" are of the usual *Polyommatus*

type, they are of a fair size, a longish oval with a strong attachment peduncle, and have five rows of reticulations usually, though in certain cases I have counted six; they are colourless. In the secondaries the same hair-like scales also prevail considerably though they appear to be slightly finer than those in the primaries, whilst it should also be noted that they are entirely confined to the male sex, not being found in any of the female forms of the species.

I do not find that the scales of the *Plebeinae* (in its broadest sense) that are brown in both sexes present structural differences from those that are blue in one or both sexes; they appear to be essentially of the same type, they are ribbed similarly and are similar in pattern, allowing of course for specific divergence.

The genus *Heodes* is very nearly allied to the *Plebeinae* and there is nothing specially to draw attention to in the structure and type of their scales. They have assumed patterns very similar to those we have been considering both as to shapes and apical terminations whilst their attachment peduncles are almost precisely the same, there are however two points in which they differ; they have no "blasenschuppen," and though their copper hue is classed among structural colours, yet viewed under transmitted light the colour remains quite apparent; this is not the case with our European blues, they are always, so far as I have examined them, transparent under transmitted light and are somewhat yellowish; it must be remembered however that this is not so with many of the tropical species, but I propose to put before you a few observations on this difficult subject a little later on.

Knowing that certain exotic genera that were magnificently blue in most of their species, and whose affinities I put rather nearer the *Ruralinae* than the *Plebeinae*, were devoid of "blasenschuppen" it was with much interest that I turned to the blue species of the genus *Ruralis* to see whether or not they would be found in them, naturally the first one to be examined was *Ruralis quercus*.

The scales generally speaking are simple, the only ones that have serrated apices being those that largely compose the

costal cable which are longish and narrow, the terminations having three short serrations, i. e. with four teeth; a smaller and slightly modified pattern also obtains in the terminal area; in the costal, cellular and other areas the scales are simple, broader and shorter in the median and postmedian regions, narrower and longer in the costal and subcostal areas and also on the fold, but all have more or less even apices, generally quite even and slightly rounded, but occasionally irregular with an indication of dentation, and among the brown neural scales many are definitely dentated. Of "blasenschuppen" however I could find no trace, and this applies to all the species of the genus that I have examined both Palaearctic and Exotic.

In *Laesopis roboris* the "blasenschuppen" are likewise absent, the blue scales are small, oval, without any trace of serration or dentation of the apices, whilst the brown scales are of the normal type with serrated ends.

In the genus *Strymon*, in which with a few exceptions the coloration is entirely brown, the scales are similar in general shape and pattern to those obtaining in other *Ruralidae*. *Strymon titus* and *w-album* are typical of all the species, and in the latter the costal cable is composed of long narrow scales tapering very slightly indeed and having one, two and three moderately deep dentations, those with the single dentation being mostly on the outer costal edge and largely confined to the basal two-thirds; as the apex is approached the scales have generally two dentations, whilst those with three are found more in the body of the cable; the subcostal area is composed of longish broad scales with three and four deep dentations among which are a few short broad ones, these latter scales also obtain in the cell and on the fold, but with the admixture of a certain number of very short broad scales, almost round, with a mere indication of slight dentation; in the postmedian area the scales are longish and narrower, with three and four sharp dentations at their apices. In general pattern those of *S. titus* scarcely differ from *w-album*, but in the detail of apices and relative width of scales there are slight differences. We find in this genus perhaps the simplest form of sex patch in the whole group; it consists

of a very small oval patch of androconia situated at the upper end of the cell and generally slightly diverting veins 6 and 7. In *titus* the colour is pale neutral grey to the naked eye, but under the microscope in a good white direct light it is warm brown, quite as brown as the usual scales but of a different tint, the androconia are decidedly shorter than the ordinary wing scale and not half their width, being very narrow, of almost equal width, but tapering slightly narrower just before the apex which is quite even and nearly straight; they are placed at a slightly different angle to the surrounding scales and are attached to the wing membrane at a wholly different angle; whilst the former might be described as almost flat with the wing surface, these are inserted at a considerable angle, as nearly as I could measure it would be from  $40^{\circ}$  to  $43^{\circ}$ , with a very considerable overlap, so that not more than the terminal third to a quarter is visible. The difference of the angle and the fact that only the ends of the androconia are seen no doubt accounts for the difference of colour, and certainly accounts for the prominence of the patch.

In *w-album* I was fortunate in being able to transfer the entire sex mark on to my slide, leaving only a few isolated scales attached to the membrane of the wing, and I found that the apices of the ordinary surrounding wing scales rise up slightly on to the edges of the brand, except at the front edge where the androconia overlies the other scales; it is also seen that the veins intercept the brand, running through it and causing a modification in the angle and colour of the scales; the true androconia are a sort of neutral grey, very closely and thickly set at angles different from the ordinary scales; those on the veins crossing the patch differ in colour from the rest, being rich dark brown, and appear to be attached to the membrane at a somewhat lower angle than the others, the androconia are fully as long as the surrounding scales, being set in a deep pit (as are all these brands more or less); they are narrowly elliptical in shape, tapering from the middle to a blunt point, and form a strong contrast to their surroundings.

In *Strymon saepium*, the brand is larger than in the European species and of a blackish colour, showing a very

marked contrast to the bright tawny colour of the species; in this instance there is a diminution of the ordinary wing scales immediately around the sex patch, there being only one layer, the bottom one, instead of two, with the result that the androconia overlies them entirely on their edges; they (the androconia) are set at different angles as usual, and are closely packed with the usual deep overlap; they are considerably shorter and very considerably narrower than the surrounding scales, being only about a third as wide, they are oblong, with base and termination of almost the same curve. The ordinary scales in this species are large, and are of quite unusual width considering the size of the species.

In *Callophrys rubi* the brand is very similar to those of *Strymon*. The androconia are a sort of dull neutral grey when seen in a good white light, and they are at a different angle from the ordinary scales; they are not however inset at nearly so high an angle as in *Strymon*, neither is there the same overlap; they are of moderate length (the ordinary surrounding scales in *rubi* are unusually long) narrow, of almost equal width, but have a slight taper just before the apex which is slightly excised, thus making the extremity shortly bifid. The scales of the underside of the secondaries of this species call for special comment. They are finely ribbed, long, somewhat narrow, with deeply serrated apices, having two and three deep narrow incisions, this pattern scale prevails practically over all the wing; the basal third of the scale is uniform in colour, being a warm brown gradually changing into the green tint; under transmitted light the colour is grey gradually altering to a brownish-red.

The shape and disposition of the scales in the Indian species I have examined are different from those we have considered before, and it will therefore be well to describe them. In *Lampides acelianus* the thick costal cable is composed of very long, narrow scales, tapering but slightly with bifid extremities, these scales are both very pale brownish, and bluish-white; those in the subcostal area are also long but broadish, tapering wider to the apices which have four deepish crenulations, the two central points being the longest; these obtain to beyond the cell, whilst in the postmedian area they become

longer and narrower and continue so up to the termen; underneath these is a layer of short broad scales, almost the shape of a Swiss cowbell, which have four deep longitudinal ribs, the apices being very slightly hollowed between them and the whole surface finely shagreened. These scales are by no means flattened but are corrugated, as they appear to rise and fall alternately with the ribs; together with these are also similarly shaped scales which are very finely ribbed; these however seen under transmitted light are yellowish-tawny and not quite clear and transparent as are some of the former ones. The cell and median area are covered with bluish scales, similar to those in the subcostal area but slightly shorter, and tapering rather more widely to the apices which are less deeply scalloped; many of these scales appear to be "fluted" and to be finely shagreened; the basal area below the cell and on the fold is clothed with the two kinds of shorter scales already referred to, but these are succeeded by the longer and broader pattern just described, whilst the post-median and terminal areas are covered with a scale of moderate length, of even width, rather broad, with more or less even apices, underneath which is a layer of the bell-shaped scales previously mentioned. The "blasenschuppen" are entirely different from those in *boeticus* and are very Celastrinid in shape and quite so in sculpture; whilst that genus has somewhat of a bell-shaped pattern, this is more scallop-shaped, but with straightish sides, tapering wider to the evenly convex apex, it has ten and eleven rows of reticulations, and the scales do not appear to be uniform in size, some being smaller than others; all are somewhat longer than broad, but very many are decidedly longer than they are wide. The scales of *aratus* are very closely similar to those of *aelianus* as also are the "blasenschuppen"; these however have twelve rows of reticulations as a rule, and the base is squarer than in the other species. Whilst the ordinary scales of *clipsis* are quite similar to the others, the "blasenschuppen" are recognisable at a glance, for they are double the length of the others though similar in sculpture and general shape; there are however only ten rows of reticulations.

The genus *Thysonotis* is also furnished with "blasen-

schuppen" more or less of the Celastrinid type whilst in *apollonius* it is further provided with another scale peculiar to the male sex, viz. one that is of quite unusual length; it is Indian club shaped, having a very long and fine stem with an elongated finely tapered club, the apical end tapering to a point much more rapidly; the term plumule suits this elegant scale admirably, it covers very largely all the wing below the upper margin of the cell, extending up to vein 7, and is especially abundant in the cell and on the fold; it is almost white, being just tinged with milky bluish, and is probably accountable for much, though not quite all, the whiteness of the special areas of the primaries of the male; it is very finely ribbed. The "blasenschuppen" proper are very closely similar to those obtaining in *Lampides elpis*, scallop-shaped with straight sides and a squarish base, the apex being evenly but highly convex, and having ordinarily ten rows of prominent reticulations, though I have in one or two cases counted as many as twelve on the one side. Very many of these scales are bright blue, others are less blue and some have no colouring at all; but when viewed under transmitted light there is absolutely no colour at all visible in some, others are yellowish shading distally into pink, or becoming colourless and transparent, others again are wholly straw yellow. As might be expected there follows some modification of the ordinary wing scales in the parts affected. The costal cable is large and composed of long narrowish scales of almost equal width, with apices very deeply bifid; mixed with these are many similar scales but deeply trifid, underneath which is a layer of broadish oblong ones with scalloped apices; all these are brown. In the subcostal area similar scales occur with others that are deeply trifid and quadrifid in their apices, and are of a deep indigo blue tint in part, generally for the apical half; mixed with these are some of the brilliant blue scales of the same pattern that obtains on the median and other areas covered by the plumules; they are longish, rather broad, tapering slightly wider to the apex which is highly and evenly rounded, the whole surface being finely ribbed; this pattern is constant for the blue scales which are sparingly present under the



plumules, the size varies slightly, some being narrower than the majority. With these is also found another scale, of the same size and shape but slightly shagreened, that is quite colourless, both under direct and transmitted light; it is to these scales with the plumules that I attribute the whiteness (already referred to) of the central portion of the primaries; in the terminal area the pattern becomes shorter and narrower, and assumes the brown hue of that region, many being however only coloured for the apical half; mixed with them also are a certain number of both the blue and the hyaline scales. On the inner margin are found some long hair-like scales (which are also found in the female in more abundance and over an extended area); the plumules are also present, and together with them is a scale, apparently peculiar to the male, which is again of the shape of an Indian club, tapering immediately from the base so that it has no thread-like stem; it is long—about two-thirds the length of the plumule, rather broad and tapering more broadly up to the apex which is highly rounded; some few of these scales are not more than half the length of a plumule, and they are found all along the inner margin and extending up the termen in the tornal area; in colour they are mostly greyish brown, all being finely ribbed, minute particles (probably of pigment) appear to be present in the brown scales, but mixed with them are some of a narrower, though similar shape, which are milky-blue, almost the colour of skimmed milk. The brown basal scales are short and broad, somewhat tulip-shaped with serrated apices, these are of irregular length and size, whilst with them are two others both quite double their length, one broad, of almost even width, with serrated apex, the other broadish but slightly wider at the apex which is evenly terminated and more or less waved. Similar scales are found in the secondaries as in the primaries, the plumules and the "blasenschuppen", being in about the same proportion, both are very abundant. The same type of "blasenschuppen" is found throughout the genus *Thysonotis*, i. e. so far as I have examined it, and I have studied a good many of the species; the plumules are by no means generally present, however, in *hengis* and several others they obtain, but in many they do not obtain, and in

consequence we find decided modification in the ordinary blue scales: in *hengis*, a species with only the least trace of a white area, they are present very sparingly, but the blue scales remain of the same type as in *apollonius* and approximately of the same pattern; in *hengis* however this pattern scale covers almost entirely the whole wing, except in the costal and terminal areas, the plumules (being so few in number) not having affected the general distribution of these scales, they merely lie on the surface, and are similar in design to those obtaining in *apollonius*, but are shorter and they are also decidedly bluer in colour: the "blasenschuppen" are slightly broader and shorter than in that species and have thirteen rows of reticulations, these scales are almost as blue as are the ordinary ones, but viewed under transmitted white light they are quite colourless, whilst the ordinary scales are yellowish.

In the species of the genus *Thysonotis* that have no plumules there is a decided change in both the pattern of the ordinary scales and of the "blasenschuppen." *Caelius* is a good example, in it the latter are short and very broad and have as many as fourteen rows of reticulations, though thirteen is the usual number; they have a broad squarish base and expand somewhat to their apex which is evenly and slightly arched, the scale being broader than long and having a strong attachment peduncle; under direct light they are almost colourless, and placed as they are (and as is usually the case) in alternate layers between the ordinary blue scales, they form a marked contrast to the deepish blue of this species; under transmitted light they are very slightly yellowish, whereas the ordinary blue scale of this insect is deepish lemon colour. The ordinary blue scales are likewise different, they differ slightly in length and width in the different areas of the wing, but follow in general shape those of the genus, being longish, moderately broad, tapering slightly wider to the apex, which however is not evenly arched but is slightly scalloped, the scalloping being very irregular, some being distinctly so, others scarcely scalloped at all.

The deep rich lustrous blue of *Hypochrysois rex* attracted attention, and in this species I found the simplest general

plan of scaling that I know as yet among the group; the whole of the blue scales are of one pattern and shape in all areas of the wing, the only modification being a very slight one in the subcostal region, where a slight narrowing takes place. The scales are longish, of moderate width, tapering but slightly wider to the apex which is highly and evenly arched; they are finely ribbed longitudinally and striated reversely rather irregularly: in the plan of these scales they are very simple also, there being scarcely any overlap at all transversely, the longitudinal overlap being likewise small; under these is a solid layer of short, broadish, dull brown scales, with even apices scarcely arched at all. The blue scales themselves are highly developed, being reticulated in the technical sense, but their arrangement is unusually simple, and there is a paucity of the upper layer of scales, though the paucity is not observable inasmuch as the blue surface appears to the unaided eye absolutely solid and even. The same arrangement obtains in both wings.

There are no "blasenschuppen" in this species, this no doubt is accounted for by the fact of there not being sufficient overlap to render them of any service.

Another group of brilliant colours called for some investigation, viz. those of a lustrous metallic nature as is represented by such species as the gorgeous green *Arhopala*, also by the similarly green species of the genus *Ruralis* and again by *Heliophorus brahma* with its wonderful metallic golden lustre, species that de Nicéville stated to be the most brilliant gems in the insect world, beside which the brightest and most lustrous of the blues were quite dull in comparison. Taking first *Ruralis duma*, a common Indian species, of a brilliant metallic green colour, I found that the costal cable was very narrow and of a light structure, being composed of the type of scales common to the genus, a long rather narrow scale with sharply serrated apices; these are all warm brown, those on the veins are also brown, square in shape with the corners rounded off, the apices being waved or very slightly arched in many cases; these are bronzy brown and both under direct and transmitted light they retain much of their bronzy hue; this is however quite different to the metallic colour of the

bulk of the wing scales; these are broadish and comparatively short, being about twice as long as the width; they are all decidedly curved, the highest part of the curve being in the centre, they are shovel-shaped, deeply ribbed, with the apices cut off quite square. There are no "blasenschuppen" in this species, nor in any of these metallic species that I am yet acquainted with. Another equally lustrous metallic green insect is *Arhopala eumolphus*, but the green is more delicate though quite as refulgent. Here again the costal cable is composed of long brown narrow scales with serrated apices, whilst the veins are also clothed with brown scales of moderate length, rather broad, with very deeply serrated apices, leaving exceedingly fine sharp points between; the metallic scales are all of one pattern, being a long oval, much longer than in *R. duma*, decidedly broader in the centre, and abruptly and evenly truncate at the apex; they are deeply ribbed and curved, but the curve is not quite so marked as in the previous species. *Heliophorus brahma* is of a wonderful metallic lustrous reddish-golden colour, probably the most brilliant insect in the world; it is allied to the genus *Heodes*, though all the other species in the genus are bluish in the males. The brown scales in this butterfly call for no special comment, but the metallic golden ones are of two sizes; those in the cell are long, broad, slightly wider in the centre, with the apices very slightly arched, not abruptly cut short as in *A. eumolphus*, those on the fold are shorter and broader, tapering somewhat wider to near the apex which is moderately rounded off, both are deeply ribbed. In the secondaries the metallic scales are shortish and broad, tapering more widely to the apex which is scalloped, the ribbing and the colour are precisely as in the primaries. There are no "blasenschuppen" in this genus. To return to the genus *Arhopala* in which nearly all the species are blue, perhaps one of the most beautiful and brilliant is *helius*, which is brilliantly deep blue in its costal and terminal area, and equally brilliantly almost Cambridge blue in the median area and on the fold; the scale in each of these cases appears to be of the same structure; the pattern is quite similar, a long broadish scale, evenly rounded at the apex and rather narrow at the

base, the scale is broader on the fold to some extent but not uniformly so, and the ribbing is the same, yet there is something as yet unknown that quite alters the shade of blue. I shall refer to this again in dealing with colours later on. *Arhopala hercules*, the largest species of the genus, is entirely very metallic deep purplish blue, one of the quite aniline colours to the naked eye and very lustrous; the ordinary blue scales over the greater portion of the wing are of one pattern, a longish, rather broad one, suddenly rounded at the basal corners and almost square at the apical corners, the apex being generally but not always quite abruptly truncated; it is of even width throughout, there being but the least and shortest possible tapering off at the apex; the ribbing is somewhat coarse; on the fold the scales are narrower; there is also a peculiar scale on the costa, more or less on the inner edge of the costal cable, it is a long scale quite tubular, narrower at the base with the normal attachment peduncle, and at the apex tapering to a blunt point; this is by no means a hair-like scale, but in this species the evolution of the costal cable scales might be said to be present; this simple one is in some numbers, there is also a second, quite similar but somewhat wider at the apex and slightly bifid, others that are wider still but tubular and distinctly bifid, whilst there are others, trifid and quadrifid, that are approaching the usual flattened scale, though quite evidently derived from the original tubular design; they are distinctly hollow tubes and are filled with minute granules of a greyish substance; they are finely shagreened with very minute lines not ribbed as the usual cable scale is; the cable itself is composed largely of the usual longish apparently flat scales with bifid, trifid and quadrifid serrated apices, the special tubular scales being more on the inner edge of the cable, though not entirely confined thereto.

Turning now to the white species of the group, I find in *Larinopoda lagyra* that the scaling is very diverse from the brown and blue sections. The fringe scales are Indian club shaped with the club very heavy, and they are very coarsely ribbed, the costal cable is composed of the same type of scale with varied apices, some as the terminal fringes others bifid

and some trifold, but the type of scale remains the same; the scales that cover the greater part of the wing are long and broadish, generally almost straight, but occasionally slightly wider at the apices which are waved and even, not dentate; with them in much smaller numbers is a lyre-shaped scale, but shorter than the one just described. These obtain in both wings.

In *Larinopoda soyauzii* we have similar types but varying in details; the fringe scales have the club much heavier; the ordinary pattern is of moderate length, narrow, of equal width, with the apex very slightly indented in the middle, just sufficiently for it to be seen; but with them in very large numbers is a most remarkable scale; it is shaped just like a trident, very broad with a heavy base, the attachment peduncle shaped up to it as in a trident, not hollowed out and with the stalk in the centre as in all the usual pattern scales; the prongs are long, and generally it is only two-pronged, though in one specimen before me there are some with a short central prong; these apparently lie in alternate rows with the ordinary pattern, and there is not sufficient overlap for the latter to reach to the solid basal portion of the trident scale, which no doubt accounts for the somewhat hyaline appearance of this species. The scales on the underside of the wing are similar in pattern but very slightly modified, being smaller, whilst in addition on the basal portion of the inner margin there are a large number of triangular scales (roughly triangular) that are not ribbed, but are reticulated (*in sens. strict.*) the reticulations being rather transverse and very definite. The secondaries both upper and under side have the same two patterns but have no reticulated ones. The scale ribs of these species are very finely lined transversely. In addition to these the veins are clothed with a small narrowly oval scale, ribbed, that is like the "blasenschuppen," in *icarus* but about twice as long. The very hyaline species generally called *Pentila muhata* (it is not a *Pentila* however, and as I shall shortly have to bring that species under review I may as well name it here, especially as its new generic name is derived from its extraordinary scales. I propose the name *Ornipholidotos* for it. as the scales look as if they were horny

whilst they are exactly like a pictorial representation of a far-away bird) has scales—all that are left to it or perhaps all it has yet attained—of a most remarkable pattern, they are all alike and yet they vary extraordinarily. A fairly accurate description of the shape is that already given of a far-away bird in the air, some scales are however the shape of the merrythought of a bird, a few are like a merrythought but with an additional outside bone on each side, at the base an occasional scale may have a broader lamination at the proximal end, one being quite a good scale very deeply trifold whilst another is quadrifid; the vast majority however have scarcely any lamina, consisting mainly of three (occasionally four) lines, a thin trident, with the prongs straight or slightly curved, sometimes wide apart, sometimes closer together. In the dark marginal parts of the wing the scales are brown, not white, and they all have more lamina than the white ones, not however that they are much more numerous. On the underside most of the scales are of the same pattern but they are almost linear. There are however at the base a number of a different pattern, being almost the shape of an oat, they are not flat, but as a grain (say an oat), coarsely ribbed, but with a covering superposed so that under direct light the ribbing shows but faintly through, though it is distinctly visible with transmitted light; the secondaries have the same pattern as the primaries. *Pentila undularis* (the type of the genus) has scales that do not call for special remark, those in the subcostal and inner marginal areas are very typical of the whole order, but the pattern of those occupying the median and postmedian areas of the wing are different; they are short broad scales, quite as broad as long generally, and tulip-shaped, the surface appears to be deeply indented up the central line, so that it has an unusual waved appearance.

In *Libys-a* the scales differ only in detail but on each vein there is a row of small narrow elliptical scales with the apices truncated and slightly excised in the centre.

In *Megalopalpus* and *Oberonia*, both genera with only white species, the scales call for no special remark. They are all somewhat typical in the main of the ordinary *Plebeid* genera,

except that in the median area there is a predominance, more or less, of the short broad tulip-shaped pattern.

Turning now to the tawny *Lipteninae* we find scales of quite a peculiar character in *Liptena parva*, a small dark brown species with a tawny red patch on the primaries and a large red basal area in the secondaries; practically the whole of the scales on the upper side are more or less pyriform, it might be more accurate to describe them as foliate or leaf shaped, and with slight modifications the whole of the scales, except the extreme marginal fringes, are of this pattern, some are longish like a laurel leaf with a rounded apex, and some are shorter and so look broader, and they obtain indiscriminately together over both brown and red areas in both the wings.

In *petreia* the same principle holds good throughout, but along the veins are found a number of lanceolate shaped scales, that do not depart from the character mentioned; there are however some very long and narrow scales present which have very deeply cleft apices. On the underside there is a continuance of the same character up to a point, many of the scales having truncated and irregular apices, but mixed with them are also a large number of scales something similar to those obtaining in *muhata*; in this case however they are just like a pair of slightly opened compasses, and would appear to be a development of the long deeply cleft scale of the upperside; a few are occasionally trifid instead of bifid.

*Multipunctata* is very typical of this genus, and in it we find precisely the same character of scale as already described; most of the upper side are foliate, some broadly, others less broad; there are the lanceolate pattern and the deeply cleft ones; on the underside the same general pattern obtains, but the scales that in *petreia* are like a pair of compasses, in this species are more like the deeply cleft pattern of the upperside, but the cleft is decidedly deeper.

I cannot close this section of African *Lipteninae* without mention of the genus *Citrinophila*, a little group of yellow species; in *marginalis* the scales are very little specialised indeed and do not need description; whilst the large black species of *Pseuderesia* from the Cameroons called *tripunctata* does



not call for special notice either; it is however more Liptenine than is *Citrinophila*.

Turning again specially to the male sex marks which are all caused so far as I have examined them at present by peculiar scales placed differently in the wing (a subject on which a whole treatise could be written easily), I have but time to take a few examples from the three great tropical Continents. Beginning with Africa, we find in *Deudorix cameroni* that there is a tuft of blackish hairs in both wings on the underside of the primaries and the upperside of the secondaries, and that in the latter there is also a peculiar patch in a reciprocal position to the tuft on the primaries, that is to say that the one lies over the other. The long tuft of blackish-brown hairs in the primaries rises from the inner margin, which is turned over to form a narrow groove for this purpose, the hair-like scales rise from it transversely across the wing reaching half up the fold, the upturned margin is clothed with longish scales of moderate width with an even ovate apex, the tuft itself being superposed over a large patch of whitish scales placed transversely and inclined basewards—all ordinary scales being placed horizontally with their apices towards the termen. This patch extends well over each side of the tuft, above which is another patch of transversely placed scales which are blackish brown and subovate in shape. The "brand" appears to affect all the scales near it, for all are of the ordinary pattern in the cell—and none of the modified pattern described extend into that area—but they are inclined transversely at an angle of about  $45^{\circ}$  instead of being placed horizontally; underneath all the special scales referred to there is the usual layer of brown scales next the membrane, but they seem to have very little pigment, being rather transparent. In the secondaries is a large patch of dark differently placed scales occupying the basal angle of veins 6 and 7 and extending into the cell over the branches of these veins; this patch has an oval iris of small white scales, and it is pupilled with an almond shaped hollowed centre of very narrow and minute darkish grey androconia; all these are placed transversely in relation to the ordinary pattern; the dark brown, very similar to those on the primaries, are the largest and occupy the same level

as the ordinary scales, the white ones are smaller, again similar to those in the primaries, but they are depressed and below the usual level, whilst the grey androconia are in a small pit, and I imagine that the main part of the tuft of hair-like scales in the primaries lies in this androconial pit. There is in addition to this the long tuft of hairs rising in the fold between veins 1a and the cell, its base is covered by ordinary scales, but on the denuded membrane is seen a short ridge which is no doubt the source of this tuft, the scales underneath this seem to be but little displaced by its presence. The membrane itself is only changed in the androconial area and to some extent in the surrounding area occupied by the white scales; it is a hollowed pit, and from the points of attachment shows the enormous number of minute scales that must be crowded in so small a space.

In *Dioples catalla* we find the tuft in the primaries to be so similar to that in *Deudorix cameroni* as not to need further mention, but the androconial patch on the secondaries is quite different; it is interesting to find that all the scales immediately surrounding the brand sweep round from the horizontal position with apices facing up to it: the brand itself is composed of probably thousands of minute erect scales, very long in proportion to their breadth, of almost equal width throughout, and having rounded apices, and packed together as tightly as possible, not flat but vertically from the membrane; this alters the whole wing below it, even the under-surface, for there is apparently a bare patch in that spot on the underside; when carefully examined however it is found to be covered with neutral grey scales which are quite transparent, and when viewed under transmitted light are quite colourless; the patch is quite peculiar, having much the outline of a full blown rose. The brands of the Indian species of the genus *Rapala* are very closely allied to *Dioples* so far as the patch in the secondaries is concerned, though they differ somewhat in the primaries; in *petosoris* there is so to speak a double tuft of hairs the larger of which has its origin on vein 1a, emitting a small and short little fringe upwards just over the vein, but sending all the long hair-like scales downwards to the inner margin (whilst another less copious one ascends

so that they cross each other, but the margin is not upturned as in *Dioptes*); these are long stout hairs; next to these nearer the base is a patch of broad short white androconia erect from the membrane. In the secondaries there is also a large brand of cream-coloured androconia composed of minute, closely packed, narrow, elliptical, short, erect scales. The number of these must be very large, for they are not more than a quarter the size of those in *Dioptes catala* and the patch is larger; the surrounding scales do not appear to sweep round and face these androconia, as in some species, and they do not seem to affect the scaling of the undersurface in any serious degree.

*Drupadia boisduvalii*, another Indian species in the Ruralid section, has a brand on the underside of the primaries, in some respects not unlike that on the secondaries in the previous species; the inner margin has been prominently excurved, no doubt on account of this large sex mark; it is somewhat shining deep cream colour, of an ovate shape, being surrounded on its three lower sides by a large area of irregular milk-white sub-transparent scales, whilst above is a narrow area of somewhat similar more regular dark brown scales, which are also transparent under transmitted light. The brand is composed of very broad scales, rather irregular at their apices, these are erect from the membrane and on the outer areas form an almost perfect honeycomb; instead of being packed closely together as in the previous cases, in the more central part of the brand the cells (so to speak) are pressed more closely and irregularly together; under the microscope the colour is almost orange with a direct light, and this is but little modified under transmitted light; this patch examined from the reverse side is quite solid showing that the formation of the cells is real and complete; the upper side of the secondaries has a reciprocal brand which is very delicate so far as the combination of its colours go, it also is surrounded by an area of small milky white sub-transparent scales, again not diverted from their usual position; the sex mark is composed of two kinds of scales, the one is of moderate length and broad and is milky white, the other is decidedly narrower, rather longer and tawny in colour, except its apex which is

bright darkish chestnut red; this has its apex slightly scalloped, whilst the broad whitish one is evenly arched; these scales are not erect though they are placed at a high angle. On the underside of the wing we find a very slight diversion of the scales under this brand, they are practically not altered in shape but the position is diverted, and instead of being horizontally placed as usual, these have their apices turned towards the costa in an irregular manner. Before leaving the Indian subregion I would draw attention to another beautiful species with an entirely different brand. I refer to *Arrhenothryx penicilligera*, a lovely brilliant pale blue species with a brand (a tuft of hair scales and patch) on the upperside of the primaries as well as on the underside, and also with another brand on the secondaries. The ordinary scales are of typical Ruralid patterns, in this instance all longish and rather narrow with dentate apices. The brands on the upperside consist of a very long tuft of white hair scales that sweep over and terminate on a brown sex mark; the former rises below the angle of vein 2, about the middle of the fold, from a patch of long broadish erect scales of a neutral tint colour that are densely packed together, which show distinctly on the microscopic slide the holes from which the hair-scales have been removed on to another slide; these scales are like thick white hairs, very long and coming from the membrane in a bold curve (necessitated by the fact that they rise in a sex brand of long erect scales); they then sweep downwards over the wing, terminating in another curve on a second sex mark consisting of long pale brownish scales with scalloped apices, which are not erect but are placed at an angle of about 45° and in a circular position all more or less facing a point about direct with the tornus; this sex mark follows the position of the tuft at first, but expands somewhat to a circular shape above vein 1. The tuft on the underside of the primaries is equally long and of quite similar white hairs that rise on the inner margin rather nearer the base than is the brand on the upperside, but the tuft sweeps forwards in a bold curve and terminates on a patch of ordinary white scales; those on the marginal area immediately below the hairs appear to be the ordinary brownish basal scales, only more transparent

than usual. The brand on the secondaries seems to me to be in process of formation; it is marked on the wing by a small, raised, almost circular area; when examined it is seen that the scales are not erect but that they are at a different angle to the others; it is composed of brown longish scales, and mixed with them are a large number of long blue scales that only differ from the other blue ones in that they are narrower, paler and longer; except for the angle at which they are inserted there are little differences in these and the ordinary ones, and this makes me think the brand is to-day in a state of development and that it has by no means reached the final stage as we know it at the present time.

In the Neotropical region the *Ruralinae*, in its strict sense, attain their highest development, the species being of the utmost beauty with marvellous development of blues and greens, at the same time the sex brands likewise have developed greatly; though various genera have been raised they are at present generally classed under the old omnibus name of *Thecla* and in the absence of any revision of the group I will use that generic name here.

In *Thecla orgia* the sex mark is fairly simple, being round and composed of closely packed longish greyish androconia of moderate width, they are almost erect and have strongly arched apices. *Thecla triquetra* has a different brand; it is composed of two sections, that nearer the base is irregularly a narrow oblong and composed of very pale ochreous brown androconia by no means erect but placed at an angle of less than 45°; they are long and narrow with apices evenly but slightly arched; the second section is large and roughly quadrangular, but with the front side slightly curved; the androconia are at rather a greater angle than the others, they are shorter and much broader, having strongly curved apices; the two sections are separated from each other by a narrow band of blue scales; at the top it consists of three or four layers of scales but tapers down to one blue one; these double section brands are not uncommon in South America, and as we shall see are developed into two large sex marks. Before however dealing with one or two typical specimens of these, I would refer to one rather beautiful one found in *Thecla*

*ocrisia*; it is roughly circular and might almost be described as like a greenish rose with the brand forming the stamens, &c.; all the surrounding bluish green wing scales are set up around it forming a raised ridge, the scales themselves looking just like the petals of a flower, the androconia being sunk in the middle (as are the stamens); moreover, to add to the simile, they are yellowish scales overlaid with chestnut red; they are not however erect, the androconia are narrow, longish, with somewhat truncated apices. The general scales over the wing in this species are excessively small and finely serrate, and are totally different in size and shape from the largish petal-like surrounding pattern and from the brand itself.

In *Thecla polybetes*, a very brilliant blue species, we find a brand with an extension, and that in a different place from the usual one. Any addition to the sex mark is usually in the costal area, but in *polybetes* it is in the lower radial area, extending from the definite brand itself (which is easily discerned) a third along vein 4, and reaching straight down to vein 2; the ordinary scales on the basal side are set up to the androconial patch, much as in the previous species, but are not so on the costal margin; the patch itself is large, consisting of closely packed nearly erect scales, pyriform in shape, with the thick end at the base and the apex gently curved; in colour they are dark brown, but there is a small patch of pale brown ones of a broader pattern and equal width; those covering the extension are different, being very broad and short, the breadth almost equalling the length, and they are not erect, but are set at nearly the same plane as the blue scales, only they have a much greater overlap. The brilliant blue scales in this insect are set at a higher angle than usual, being by no means so flat, and they are curved, as is not infrequently the case with the very metallic blue and green colours. In *Thecla phaleros*, another metallic blue species, the brand is set in a deep pit, the sides of which are set with the ordinary brilliant blue scales (set petal-ways); from the base of the pit it rises up like a minute crater, up whose sides very large broad scales of a pale brownish colour rise, and they appear to be of an unusual length, though it is extremely

difficult to judge this accurately owing to their peculiar position and arrangement; inside this miniature crater the true androconia are placed, those at the circumference being at a much lower angle than the others, which become more vertical towards the centre, the centre itself being also at a perceptibly lower level than the rest, and we must suppose therefore that the androconia are shorter in the middle; these scales in their vertical position are very deep coffee brown, though those on the circumference, where more of the scale is visible, become paler. This brand (a very beautiful object) is quite complete in itself, but at the upper posterior corner (not that there can be a real corner to an almost circular object) there is an extension, which has the appearance of a gradual development into a second brand; it is very pale coffee brown in colour (the other to the naked eye is black), and extends over the bases of the subcostal veins across the cell to vein 5; the scales are minute in comparison with the blue ones around, and are set at quite a different angle; this extended sex mark is not set in a pit as the other, but is more on the usual plane of the membrane though it is evident at the base of the subcostal veins that some alteration is in process of development. *Thecla polybe* shows this process of development in a more advanced condition, the two black brands being very marked, but the second one has not yet created the pit in the membrane as has the first; this species has not by any means the crater-like arrangement of *phaleros*, though it is in a pit, the difference being that there is no outer ridge around it, but the blue scales are set petal-ways up to the depressed area in which is the brand; the androconia within are deep black even under the microscope, the surrounding scales are very broad and square, broader than long, and with an arched apex; whilst the inner layers of the surrounding scales are of different sizes, all are very broad with broadly scalloped apices, some assuming almost a truncated "fleur de lis" shape: the blackish androconia are of moderate length, rather narrow, equal in width, with strongly arched apices, these being set, if not erect, at a very high angle; this brand is finely separated from the outer one, which is also blackish and of almost equal size, not being set at quite so low a level; the androconia are nearly

the same shape but taper slightly, the distal end being the smaller; the ordinary scales around are not set up to this brand, but are rather overlaid by the androconia whilst the "mark" is crossed by two veins which modify both the colour (brown instead of black) and the size of the scales clothing them. Though the apices of the androconia are black this colour is only at the apices, the lower parts being pale brown; this however is by no means of infrequent occurrence.

A discussion on the scales of the *Ruralidae* could not be closed without some reference to the unique and primitive though extraordinarily specialised genus *Liphyra*, with the delicate white fugitive scales attached to its wings on emergence from the pupa, and with the yet more peculiar body scales all of which probably disappear after the first flight or two; both are quite evidently protective developments. The long white scales of the wings are much the shape of a lily of the valley leaf with its end truncated and scalloped; in size they vary considerably, whilst the scalloping of the apex varies yet more; some have two scallops, others go up to four or five; the point of attachment is also peculiar, there being a twin attachment excavated between the two points which are almost at right angles to the stem, this being no doubt necessary to allow it to be easily freed from the ordinary scales; this is the usual method, but occasional scales are present with but one; they are all ribbed, the ribbing not being particularly fine. Under direct light the colour is pure white, but under transmitted light grey, more or less transparent. The body scales are however much more unique than these just described; the abdomen of the imago looks to be densely covered with silky fluff, the word fluff is the only word that adequately describes it, this however under the microscope is found to consist of scales of extraordinary size and structure; they are exactly like the egg case of the skate, but instead of having a long filament at each corner, they have one from each end in the centre, that at the one end being very long indeed, frequently much longer than the rest of the scale, whilst that at the other end, probably the end of attachment, is by no means as long and not infrequently has two points of adherence (*i. e.* Y shaped), the stem of



each being of moderate length; these scales also vary much in size and in the length of the filaments; in the smaller ones the likeness to the "mermaid's purse" diminishes, they are rather coarsely striated, the striations being by no means sufficiently uniform to be called ribbing. In colour they are golden brown under direct light, and are much the same hue by transmitted light. When it is remembered that the whole abdomen is covered with these scales, their number must run into very many thousands; their size and arrangement must make them almost perfect for their purpose, so that when ants attack the newly emerged butterfly the long filaments at each end must be most admirably adapted for curling round and adhering tenaciously to their antennae, and thus ensuring a hasty retreat.

Inasmuch as all the metallic greens of the *Ruralidae*, when seen under transmitted light, showed that they had no green pigment but that their basis was mauve or pink to red, it became necessary to investigate the allied colours in other genera. I therefore first looked to the great family *Papilio* and made several preparations, among others, of *Papilio blumei*. This is a very brilliant bluish-green species. I found the general pattern of the scales to be very diverse from those of the *Ruralidae*; the shape is pyriform, the scales being very coarsely reticulated, there being only ten rows of reticulations on these large scales (in a few very broad scales I counted as many as thirteen rows); the ribbing and the transverse ribbing are very deep and very irregular, being roughly quadrangular, but the quadrangles are of very varied sizes and they appear to contain one globule of (I suppose) pigment of a magenta colour (under transmitted bright light); in examining this, I reflected a very intense white light through the scales, the result being that the lines of the reticulations were finely buff colour whilst the contents were pinkish magenta; absolute sunlight, reflected through, left the same colours only intensely clarified; an ordinary but clear light produced dull ochreous lines and dull magenta colouring inside the lines; it will thus be seen that the general colouring was the same in all lights, it being simply a question of degree of brilliancy. Here again there was no bright bluish green

visible at all under transmitted light, just as it was with the *Ruralidae*.

I ought perhaps to emphasise the fact that it is necessary to examine isolated scales if the real colour is to be ascertained; if scales, overlapping each other or lying on the top of one another are considered, quite a different effect may be produced upon the eye owing to both diffraction and refraction.

In *Papilio ulyssees*, a brilliant azure blue species, the scale is very close in structure to *blumei*; the shape is not pyriform however, being broadish at the base and only increasing slightly in width to the weakly arched apex. The reticulation is less coarse, there being twelve and thirteen rows, as compared with ten; the transverse lines also are finer and the reticulations more regular, the colour of the lines is deep straw, the interior area being brownish mauve under transmitted light (it is a hue almost impossible to describe). Under condensed direct light it is seen that the general surface of the scale is blue, but the great brilliancy of the species is caused by points of brilliant blue placed at the bottom of the ribs, not on the top; they are at the four corners of the reticulations, and would therefore be accounted for by the fact that more light was available at those points, as the chitine would be thinnest at those cross points and more light would come through. All reticulations have the appearance of being minute bright blue plates overlapping each other slightly. The green points in the primaries of *paris* are caused by isolated scales very similar in shape to *blumei*, but narrower; these points are very green under direct light, and the structure of the scale is similar, being reticulated, and only differing in degree; by transmitted light the colour is red, something of the tint known as Indian red, these isolated scales are in the midst of black scales of quite a different pattern and structure; the brilliant greenish patch in the secondaries has scales of a different shape and slightly different in the pattern of the structure, they are pyriform, but taper down somewhat from near the middle, which is the widest point, to the apex, this being slightly hollowed in the centre. The reticulation is exceedingly coarse, there are but eight rows of very deep reticulations; by transmitted light the scales are very solid,

the basal area being pale golden brown becoming rapidly reddish, almost the colour of a pale garnet stone; in many cases they are entirely reddish.

*Ornithoptera brookeana* is the only one of the Rhopalocera I have examined that forms an exception to the rule that greens in butterflies have for a basis pinks to reds including pinkish violet; the beautiful sheen that this species has in its metallic green transverse bands is well known. The scales are very different from those of the genus *Papilio*, being almost paddle-shaped with a broadish base, and the apex slightly truncated; the deep lines and reticulations of that genus are quite lacking, the surface being lined, but so exceedingly fine is this lining that the lines are on the average but  $\frac{1}{1250}$  m.m. wide as against  $\frac{1}{700}$  m.m. in *Polyommatus galathea*, in which species the ribbing is rather fine than coarse for the *Ruralidae*. The brilliant glossy green of the *brookeana* scales retain their colour under transmitted light, becoming lighter and losing much of the metallic sheen. Now at last I thought I shall find some green pigment: such however was not to be the case. The scale itself behind the green looked and proved to be very solid, they look to be filled with dense black pigment as they lie over each other, the metallic gloss being partial; on removing the upperside of the scale, I found there was left nothing but a dull greyish brown colour on the lower part of the scale sack; on removing the lower surface of the sack, the upper finely lined chitinous side retained all its lustre, this upper side I discovered to be very hard and brittle; it can be split and is easily broken, but in all cases the colour is retained, and I have come to the conclusion that in this case the chitine itself must be coloured. I am aware that the colour can be dissolved to a considerable extent, and I am now testing this but it is not completed; I believe however that in this instance the real colouring matter is not in the scale sack but, contrary to the *Ruralidae* at least, the chitine itself is coloured, i. e. the colour is subcutaneous.

*Ornithoptera priamus* is quite different. Whilst the structure and pattern of the scale is almost precisely similar to *brookeana* (the shape is somewhat different however), the colouring matter is quite diverse; its brilliant and almost pure

green is well known, but under transmitted light it is fiery red to reddish orange, according to the intensity of light and the angle of the scale; when examined under a moderately high power under the microscope it is found that the surface appears to be closely dusted over with exceedingly fine and minute points of green, these points are I have little doubt determined by the width of the lines or ribs wherewith the chitine is covered, and it is only where the light falls that the green colour is visible; [under a quarter objective it is scarcely possible to get the whole scale under direct light, as the scale is strongly curved, this of course would not happen with the full play of light upon the scale or wing]; this however entirely disappears if transmitted light is turned on. With the lower surface of the sack removed, it is found to be filled with a finely granulated substance of a pinkish colour, and in certain places, where the lower surface had taken with it some of the pink material, the finely lined upperside was visible and was deep yellow in colour. The consideration of the colour problem made it necessary to examine other colours as well. Yellow being a close ally of green in some ways, I turned to the beautiful lustrous yellows so well known in many of the genus we are considering. In *chimaera* the yellow is very golden and metallic, I found the scales closely allied to *priamus* in shape and general appearance; the contour differed, and the lineation of the scale differed slightly, not being so fine. Under transmitted light the colour remains clear bright yellow; all it loses is the metallic lustre; this is without doubt caused by the lineation. Removing one surface of the scale the same clear bright yellow still remains, showing that the colour is due to pigment in some form and not to diffraction. *Ornithoptera miranda* shows precisely the same thing, only in this species it appears as if there was an outer sack containing the inner one; if this is the case, it being very finely ribbed as is the inner one, it might well be the cause of the beautiful golden lustre.

In the Erycinid *Rhetus periander*, a species as bright in its blue colouration as the majority of the *Ruralinae*, the blue scales and the location of the colour is different. They (the blue scales) are diverse from the other scales which are very

broad, indeed almost as broad as long, somewhat squarely oblong with bluntly dentated apices, having as many as seven to nine dentations. The blue scales are, however long, of but moderate width, suddenly expanding at about a fifth from the apex where it is arched in its contour, and it is only this more or less curled tip that is blue, all the rest is sienna brown; in some cases the blue apex is decidedly and evenly hollowed out, but in the greater number of the scales this is not so, the apex being more generally slightly uneven. The interesting part is that all the blue colour is entirely confined to the apical half and to a large extent to the apical fifth of the scale, the brightest part being the apical curved fifth. The difference in the method of scaling may be seen even with a tenth hand lens, when it can be observed that the scales are not wholly blue, they are very irregularly and unevenly striated, the striations being very fine; they are densely filled with pigment that under transmitted light is golden brown, though under a direct light the blue colour is very bright.

In *Morpho aurora*, a species more brilliant in its blue than most of the *Ruralidae* and as brilliant as any, the case is different. Here we have a colour more susceptible to light than any that I have yet examined, for its colour changes somewhat according to the intensity and whiteness of the light. Under direct light, in bright sun with the light condensed intensely, the blue colour is at its highest point; as the light is reduced the colour is likewise reduced until it becomes blue grey. In the *Ruralidae* there is no real change of colour, even though the hue may be intensified. Under transmitted light, with the sunlight transmitted through the scales, the colour becomes slightly lilac grey, but scales with the upper ribbed chitine removed are absolutely transparent and colourless; under very clear white light (as obtainable on a brilliant day with white fleecy clouds) the colour is yellowish opalescent. If placed under very white artificial light (transmitted) the scales are opalescent, showing slightly the colours so well known in Australian opals, but not the fiery hues of the Mexican stones. In this case, as in all others, these remarks apply to isolated scales, directly they begin to overlap each other a different effect is produced; the blue asserts itself

more owing to double diffraction and also to refraction, so that it is necessary to be most particular for all observations to be made on isolated scales so far as they relate to these structural colours, *i. e.* to colours that differ from the pigment found within the scale.

In closing I must refer to my investigations on the colours of the scales we have been considering. I can of course only refer to a few more or less typical species, or to those that differ from the usual rule. It will no doubt be understood after my previous remarks that in all cases I am dealing with isolated scales only; in many instances I have removed the upper ribbed chitinous surface of the scale sack, and frequently the lower surface, my object being to find the contents of the sack.

*Plebeius argus* under transmitted light has scales (blue under direct light) that are quite colourless, some being the very palest straw colour. On removing the ribbed upper wall of the sack a very fine granulated surface is disclosed that is absolutely colourless and transparent.

*P. sieversii*, a decidedly blue species, is under transmitted light straw colour, as also are the thick hair-like scales; with the ribbed chitine removed the sack is granulated, the pale yellowish granules lying in fine lines so as to coincide with the ribbing, the hair-like scale was likewise granulated but with the chitine removed appeared to be quite colourless.

*P. eversmanni* has its blue scales reddish buff under transmitted light; with the ribbed wall removed, the sack is roughly granulated, the pinkish granules not being confined to the lines of the ribbing.

*Polyommatus icarus* is pale lemon yellow under transmitted light; with the upper wall removed a very finely granulated surface is disclosed, which under a moderately high power is found to consist of minute yellow granules that follow precisely the lines of the ribbing.

*P. thetis*, with its clear and beautiful blue, becomes under

transmitted light transparent clear deep lemon colour; the ribbed wall of the sack having been removed reveals a slightly granulated deposit that is very pale pinkish. The tubular hair-like scales are paler yellow than the others.

- P. eros* is pinkish buff with some intermingling of yellowish buff under transmitted light, and these colours were scarcely changed by condensing direct light upon them; though usually blue reflections show themselves if this be done whilst under transmitted light.
- P. anteros* is pale silvery blue, but under transmitted light is pinkish. The colour of the "blasenschuppen" is not discernibly different from the ordinary blue scale under direct light, but is pale yellowish under transmitted light.
- P. damon* becomes semitransparent dirty straw colour proximally, shading into mauve distally; in this species I removed the lower wall of the sack with the result that the upper ribbed wall appeared to be transparent and clear and was quite colourless; no granules could be found, so that probably pigment when present is in the lower portion of the scale sack.
- P. meleager*, with its bright clear blue, becomes under transmitted light deepish straw colour, the blue hair-like scales being also of this colour.
- P. semiargus* is a strong darkish blue, but under transmitted light the scales become unusually clear pale straw colour; with the upper ribbed wall removed a finely granulated surface is revealed whose colour is almost imperceptible.
- P. galathea* is lemon yellow under transmitted light; with the upper wall removed, a coarsely granulated surface is disclosed, the granules being exceedingly pale yellowish.
- Celastrina argiolus* under transmitted light is of the palest possible yellowish, practically the colour of the chitine itself.
- Lycaena arion* becomes straw colour under transmitted

light, but with the ribbed upper wall removed, the scales are absolutely colourless.

*L. iolas* is lemon colour, as also are the thick hair-like scales; in the latter however a considerable number of grey granules are present.

*Lampides aelianus* is almost more white than blue under direct light but the scales become quite transparent and colourless under transmitted light; this applies both to the ordinary scales and to the "blasenschuppen." As an opaque object under very white condensed light, a single scale has a slightly milky appearance, but if placed over other scales the very pale whitish blue is at once apparent; the "blasenschuppen" are dirty cream colour, but over other scales they are exactly the same colour as the ordinary ones.

*Thysonotis apollonius* has the ordinary scales pale very bright blue, the two sex scales are also blue, the plumules being pale whitish blue under direct light, but transmitted light shows that there are two kinds of these plumules, one of which becomes quite transparent and colourless, whilst the other is finely shagreened all over and is dark neutral grey. The "blasenschuppen" are sometimes clear and colourless, but generally have a yellowish tinge: the ordinary scales become tawny yellow.

*T. hengis* again has the "blasenschuppen" blue, but under transmitted light they are clear and colourless. The ordinary scales are of a strong mauve blue, but under transmitted light they become pale yellowish, showing thus a marked contrast in inverse degree from that obtaining in *apollonius*.

*Thysonotis caeleus* is quite deep blue in colour, but under transmitted light it is deepish lemon, the "blasenschuppen" being very slightly yellowish, though under direct light they are practically colourless.

*Hypochrysops rex*, with its intense ultramarine blue, becomes deep bronze under transmitted light.

*Arkopala helius* is deep rich purplish blue, becoming pale



silvery lustrous blue in the median and lower radial areas; under transmitted light the deep blue becomes deep lemon, the graduated shades become orange, whilst the pale silvery blue becomes pinkish buff, several quite pinkish scales being present. The upper ribbed surface having been removed left a closely granulated pink surface, the colour being the same both with the orange and pinkish buff scales. On to this pink granulated interior I condensed a very white light, but it merely intensified the pink hue, whilst the same result was produced by condensing sunlight on to them. I therefore removed from other scales the lower surface of the sack, leaving behind only the ribbed upper chitine, no granules at all were present, the ribs being almost transparent very slightly yellowish.

*Arhopala hercules* is a rich, metallic, deep purplish blue, entirely uniform in colour all over the wing. Under transmitted light it is clear lemon yellow. With the upper ribbed chitine removed the same clear yellow is maintained, the surface being granulated exceedingly finely. The base of the scale was almost colourless but became rapidly coloured beyond the proximal end.

*Arrhenothryx penicilligera* is a beautiful pale blue, becoming clear transparent lemon under transmitted light; with the upper wall removed the interior is densely and finely granulated with minute lemon-coloured granules, whilst the white hair-like sexual tufts are greyish with transmitted light.

*Thecla orgia*, with its lustrous sky blue, becomes deep straw colour.

*T. polybetes* is brilliant metallic blue, but becomes under transmitted light deep bronzy straw colour.

*T. phaleros* is bright metallic blue and also becomes bronzy straw colour.

Most of the South American metallic blues are under transmitted light of a bronzy hue so far as my observations go.

*Ruralis duma* is lustrous metallic green inclining to yellow

green, the wing scales are deeply ribbed, and instead of being roughly flat are curved; when examined under transmitted light the colour becomes a delicate pinkish heliotrope.

*Arhopala eumolphus* is also lustrous metallic green but inclining to bluish-green; the scales are deeply ribbed and curved; under transmitted light they become pinkish mauve, different in hue from *R. duma*.

*Heliothorus brahma* is fiery metallic reddish golden colour, and becomes under transmitted light uniformly green, with no tinge of yellow but rather of the bluish hue if anything.

*Callophrys rubi*, with the well-known green colour of its underside, is quite different from the metallic greens obtaining in the exotic species. To the naked eye the colour looks uniform but the scales are really brilliantly mottled, the mottling under a good direct white light being very conspicuous and very brilliant. Under transmitted light the scale is found to be packed with reddish globules which lie in the sack quite regardless of the ribbing; they are very irregular in size and shape, and whilst not entirely confined to the apical portion are much less plentiful proximally, with the result that that portion is pale greyish, but rapidly becomes reddish distally.

*Pithecopis dionysius* is very white on its underside, but under transmitted light there is a faint brownish reflection; with the upper ribbed wall removed it is densely but finely granulated with granules of a greyish tinge.

*Larinopoda lagyra* is quite white to the naked eye and remains rather transparent whitish with transmitted light. When the ribbed upper wall had been removed the scale was not found to be empty but was heavily granulated with grey; the granules however were quite invisible as an opaque object.

*Larinopoda soyauxii* is slightly creamy white but becomes yellowish under transmitted light; the upper chitine being removed discloses a coarsely granulated surface,

quite irrespective of the ribbing the granules being greyish.

*Penula nubata* is brown under direct or transmitted lights in its brown areas, and with the upper chitine removed reveals a dense granulation of darker brown. The whitish areas are the same in both lights, but on removing the upper wall the surface is finely granulated with almost transparent globules.

*Penula undularis* is quite white but becomes yellowish transparent white under transmitted light; with the ribbed upper wall removed the scale is coarsely granulated, the granules being transparent, except on their circumference which is greyish. Under direct light the scale is quite invisible as an opaque object, when the ribbed surface is gone.

*Oberonia ornatus* is pure white, but under transmitted light becomes hyaline dirty straw colour; with the upper ribbed wall removed the interior is seen to be very finely granulated with transparent greyish granules.

The tawny red species of the genus *Liptena* are almost the same colour under both lights.

These investigations lead me to believe that blue pigment does not exist, but that though in some cases the scales appear to be quite colourless, yet in the great majority of cases blue colour seems to require a basis of yellow for its production by diffraction. In all the species that I have examined there is an under layer of brownish scales below the blue ones, which doubtless absorb unneeded light and in the case of the colourless scales probably assist the colour in some method.

The case of the metallic greens is less conclusive inasmuch as *Ornithoptera brookeana* may prove to have a subcutaneous colouring matter; but apart from that there appears to be no evidence so far as the *Rhopalocera* are concerned that there is green pigment present, nearly all the greens requiring a basis of pink to red whilst the strongly metallic and refulgent greens appear to require a basis of violet or lilac for their production. The whites have also very rarely white pigment, and are

very rarely empty scales; grey or brownish seeming to be the pigment necessary to produce the effect of white to the unaided eye, *this is confirmed by a reference to the genus Delias* whose species are very solid in their whiteness, whereas under transmitted light I find the scales are decidedly brown in the one or two species I have examined. In making these final remarks I have no wish to dogmatise and I only state what my own investigations have shown me. I might further add that in all my many hundreds of microscopic preparations I have trusted to no one but myself, for I have made them all with my own hands, it being a subject that has occupied my attention for a good many years.

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## ERRATA.

## TRANSACTIONS.

- Page 230, line 21 from top, for *parallelipipedus* read *parallelopipedus*.  
 Page 252, line 7 from top, for *parallelipipedus* read *parallelopipedus*.  
 Page 270, line 20 from bottom, for *Hemisodorus* read *Hemisodorcus*.  
 Page 546, line 1, for *eubara* read *euboea*.  
 Page 556, line 7 from bottom, for *eubaea* read *euboea*.  
 Page 556, line 6 from bottom, for *eubara* read *euboea*.  
 Page 556, line 6 from bottom, for *Heterchroa* read *Heterochroa*

## PROCEEDINGS.

Page cxxx, line 23 from top, for *ardipus* read *oedipus*.

## CORRIGENDA

## THE BUTTERFLIES OF THE WHITE NILE, by G. B. LONGSTAFF.

Page 29, line 15 from bottom, *delete* "Yerbury records *H. iterata*, Butler, for Aden." The paragraph should read—

"The form, *H. iterata*, Butler, is recorded for Somaliland (Lieut. Sparrow), as well as for German East Africa, and British East Africa. Aurivillius† 3. p. 389) doubts whether it is specifically distinct."

Page 51, line 17 from bottom, *delete* "with the notable exception of the total absence of the great genus *Acraea*."

Though it is true that no *Acraea* has been recorded from the Aden district, *A. doubledayi arabica*, Eltringham, has been taken in the Azraki Ravine in Southern Arabia [Eltringham, 14, p. 174], also *A. neobule arabica*, Rebel, has been taken near Makalla, as well as at Räs Furtak, both in S. Arabia, c. lat. 11° N. and 16° N. respectively. *Lepidopteren aus Südarabien u. v. d. Insel Sokotra*, Prof. Dr. H. Rebel, LXXI. B. (II. H.), p. 28. K. Akad. d. Wiss., Wien.).

Consequently the table on page 50 should read—

<i>Acraetinae</i>	5	2	0
<i>Pierinae</i>	33	18	15
	—	—	—
Total	75	51	37











